California Agricultural Teachers' Essential Guide to Safety

06/2017

Contents

Introduction

When working in the shop, using equipment, or running the school farm the number one concern is health and safety of yourself and your students. Agricultural education often occurs outside the traditional classroom. The "Learning by Doing" approach involves developing hands on experience in the class activities, in SAE, and FFA activities. Activities outside the traditional classroom by their very nature are less structured and require additional vigilance on the teacher's part. Indeed this hands-on experience is the heart of Career and Technical Education. Some additional risk when working with tools, machinery, and animals is unavoidable. The purpose of this guide is to make teachers aware of these risks, their responsibilities, and provide tools to manage the risk and educate their students to these hazards.

Educators have a responsibility, to both students and their parents, to provide a safe learning environment in which the risk of personal injury is low. For agricultural educators, however, this responsibility is compounded by the fact that students often have little or no experience working in hazardous environments where the knowledge of risks and the need for safe work practices are crucial. Supervised agricultural experience (SAE) projects are another area where risks are higher because the environment is less controlled than in the classroom setting.

Every school district will have their own set of guidelines and rules to follow. This guide is not intended to be a rule book, but rather a guide to help teachers be aware of their responsibilities and the hazards associated with agricultural education.

This safety manual for agricultural educators was prepared by Dr. Michael Spiess and Kathleen Reid in 2006. The manual was revised in 2009 by Michael Spiess and expanded in 2016 by Heather S. Clark and Michael Spiess.
The goal of the project was to create a guide to promote health and safety in agricultural education facilities. While this manual was developed for use by California agricultural teachers the vast majority of the content is applicable to all programs.

Disclaimer

The aim of this guide is to assist in the prevention and reduction of injury and disease in school agricultural education shops and farms. However, this guide cannot and does not warrant the accuracy or the completeness of this instructional guide and materials, and as a result, we will not be liable to any person or organization for any loss or damage of any nature, whether arising out of negligence or otherwise, which may be occasioned as a result of the use of this instructional guide and materials.

Agricultural Content Standards[1]

The adopted agricultural content standards speak regularly to safety instruction and practice. The applicable standards are:

Foundation Standards

6.0 Health and Safety
Students understand health and safety policies, procedures, regulations, and practices, including the use of equipment and handling of hazardous materials:

- 6.1 Know policies, procedures, and regulations regarding health and safety in the workplace, including employers' and employees' responsibilities.
- 6.2 Understand critical elements of health and safety practices related to storing, cleaning, and maintaining tools, equipment, and supplies.
- 6.3 Understand how to locate important information on a material safety data sheet.
- 6.4 Maintain safe and healthful working conditions.
- 6.5 Use tools and machines safely and appropriately.
- 6.6 Know how to both prevent and respond to accidents in the agricultural industry.

Agricultural Mechanics Pathway

B1.0 Students understand personal and group safety:

- B1.1 Practice the rules for personal and group safety while working mechanics environment.
- B1.2 Know the relationship between accepted shop management procedures safe working environment.
- B1.3 Know how to safely secure loads on a variety of vehicles.

B8.0 Students understand electric arc welding processes:

- B8.1 Know how to select, properly adjust, safely employ, and maintain appropriate welding equipment (e.g., gas metal arc welding, shielded metal arc welding, gas tungsten arc welding).

B9.0 Students understand advanced metallurgy principles and fabrication techniques:

- B9.2 Operate and maintain various arc welding and cutting systems safely and appropriately.
- B9.3 Operate and maintain fabrication tools and equipment safely and appropriately.

B11.0 Students understand the principles and applications of various engines and machinery used in agriculture:

- B11.2 Operate and maintain equipment safely and efficiently.
- B11.3 Know the various types of engines found on agricultural machinery and understand the theory and safe operation of their systems (e.g., cooling, electrical, fuel).

Animal Science Pathway

D1.0 Students understand the necessary elements for proper animal housing and animal handling equipment:

- D1.3 Understand the purpose and the safe and humane use of restraint equipment, such as squeeze chutes, halters, and twitches.

[1] Published by the California Department of Education. Available at: http://www.cde.ca.gov/ci/ct/sf/documents/ctestandards.pdf

D1.4 Understand the purpose and the safe and humane use of animal husbandry tools, such as hoof trimmers, electric shears, elastrators, dehorning tools, and scales

D6.0 Students understand the causes and effects of diseases and illnesses in animals:

D6.4 Understand prevention, control, and treatment practices related to pests and parasites.

D6.5 Apply quality assurance practices to the proper administration of medicines and animal handling.

D6.6 Understand how diseases are passed among animal species and from animals to humans and how that relationship affects health and food safety.

D8.0 Students understand the challenges associated with animal waste management:

D8.3 Understand the health and safety regulations that are an integral part of properly managed animal waste systems.

Forestry and Natural Resources Pathway

E9.0 Students understand the role of fire in natural resource management:

E9.3 Know appropriate wildland fire-suppression practices.

E9.4 Understand the components of a fire-control plan.

E9.5 Know how to use fire-control tools safely.

E9.6 Know the training requirements for fire-suppression certification.

Ornamental Horticulture Pathway

F4.0 Students understand basic integrated pest management principles:

F4.1 Read and interpret pesticide labels and understand safe pesticide management practices.

F9.0 Students understand the use of containers and horticultural tools, equipment, and facilities:

F9.2 Operate and maintain selected hand and power equipment safely and appropriately.

Acknowledgements

Safety is not new! Materials for this manual were developed from the author's classroom materials and from many different sources. Many ideas for this manual came from the following general sources:

Safety Guidelines for Technology Education & Elementary Science / Technology Education. Pennsylvania Department of Education, Bureau of Curriculum and Academic Services, Division of Curriculum and Instruction. Available at: http://www.education.pa.gov/Documents/Teachers-Administrators/Curriculum/Science%20Education/Safety%20Guidelines%20Science.pdf

Heads Up! For Safety. Ministry of Education (MEd) and the Workers' Compensation Board of BC (WCB) Available at: http:// www.bced.gov.bc.ca/irp/resdocs/headsup.pdf

Safety Guide for Career and Technical Education. Career and Technical Education, Washington Office of Superintendent of Public Instruction. 2002. Available at: http://www.cdc.gov/niosh/docs/2004-101/pdfs/Safe.pdf
This guide has many additional safety topics with quizzes.

Where specific materials were adapted for this manual they are cited. Additional references can be found at the end of this manual.

Implementing Safety in an Agricultural Education Program

The ideal program (or work place) develops a culture of safety. Learning to work safely and be conscious of safe practices is a valuable skill for all students in career and technical education to learn.

The School as a Model Environment

Schools should always seek to model best practices since this is where students often learn about a subject for the first time. The facilities should model a safe environment and the teacher must model safe practices. For example a teacher should always wear safety glasses in the shop, thus modeling the expected behavior of the students.

Safety in the school is composed of two important components: the physical facilities and student knowledge and attitudes.

Facilities:

Keeping facilities safe is an ongoing task. This guide provides a number of checklists that can be used by teachers to assess the safety of the school farm or shop. Teachers should strive to keep their facilities as safe as possible. Keeping facilities safe requires continuous vigilance to insure that machinery, buildings, greenhouses, etc. are in good repair and orderly. Keeping your facility safe may mean working with the school maintenance staff, doing your own adjustments and repairs, replacing unsafe equipment, and/or disabling unsafe equipment.

Education:

Educating students about safety can be a challenge. How do you provide them with enough information to ensure their safety without overwhelming them or losing their interest? And what do you do about those students who are inclined to disregard safety instructions with a wave of bravado and misplaced confidence? Unfortunately, this guide can't solve all the safety problems, but it does offer you some suggestions on how to build safety into your current and future programs.

We suggest that an agricultural education safety program be organized into manageable units that focus on the important safety points and repeat the crucial ones. Provide an introductory lesson about safety in shop or farm settings for all students entering the agricultural education program. Alert students to the health and safety issues that arise during instruction (teachable moments), the roles and responsibilities of everyone involved, and appropriate attitudes in the work place. The ability to work safely is an important career skill and can be part of a career unit as well as skills lesson.

Following is an outline of the process we recommend for integrating safety into your agricultural mechanics program:

1. Supply basic safety instruction on the general use of hand tools and the handling of agricultural and shop materials. This lesson could be given to students before they move from the design phase of a project to the implementation stage.

2. Give a general overview on the safe use of portable power tools for all students enrolled in shop programs.
3. Discuss generic safety considerations and procedures that apply to the use of all stationary power tools and equipment. This lesson could be given to students as they approach the phase of their project work that requires the use of power tools.
4. Provide instruction and testing on the safe use of each power tool before qualifying students to use the tool in the school shop.

When giving a lesson on a particular tool, describe (simply and briefly) and demonstrate the tool and how it operates. Each lesson should cover the following areas:

1. purpose of the tool;
2. operation of the tool;
3. potential hazards of the tool; and
4. controlling the hazards.

Following is an outline of the process we recommend for integrating safety into your school farm/greenhouse program (non-shop):

1. Supply basic safety instruction on the general use of tools, equipment, and materials the students will be handling. This instruction can be included in an introductory agriculture course.
2. Reinforce safety with each lesson. For example if a lesson uses a strong disinfectant, students would be instructed on the hazards and required to wear safety glasses. Building this awareness of safety will train students to work safely.
3. Don't let students "fall through the cracks" of your safety program. Transfer students and absent students need instruction.
4. Be sure to include safety in SAE projects. A group meeting is an efficient way to introduce safety to students with similar projects. Because SAE by its nature is less supervised (than a classroom) and less controlled more of the responsibility for safe work lies with the students. It is an important career lesson for students to learn how to work safely when not being directly supervised.

When giving a lesson you should cover the following:

1. Identify the hazard(s) and risk(s)
2. Describe how to minimize the risk (e.g. using protective equipment, proper ventilation)
3. In case of chemicals what to do if exposed.

In teaching about potential hazards, students should be encouraged to think about the tool or material hazards to themselves and others on their own. It is particularly important to identify hazards to eyes and hands. If students learn to ask and answer these kinds of questions for themselves, they will have acquired a valuable skill in regards to their own and others' safety—the ability to predict and control hazards.

When a teacher makes safety an integral part of the instructional program, it is learned in much the same manner as skills and operations. However, safety can also be 'caught' as readily as 'taught,' implying that proper safety attitudes and practices are contagious and their development strongly influenced by the teacher's attitude and conduct. Safety does not just happen, but is the result of a well-planned program administered and modeled by the agricultural education teacher.

Tracking Safety Training

California law requires employees to be trained on the hazards associated with their jobs and records kept to document the training. This process seems prudent for teachers as well. For classroom instruction filing safety quizzes or signed copies of safety rules would document safety instruction. Teachers must be vigilant to track safety instruction

In the area of SAE teachers are more likely to do instruction one on one. Tracking this instruction is more difficult but necessarily important. Group orientation sessions can reduce the time involved in safety training and make documentation easier. Developing a training sheet for each student (see below) is an easy way to track training. These can be customized to the type of project. If students have completed a course which includes safety training simply note the course on the form and year it was taken.

Sunny Valley High School SAE Safety Training

Student: _____

Training	Date	Trained By
Animal Projects		
Animal Handling Safety		
Crops Projects		
Tractor Safety		
Harvester Safety		
Chemical Safety		
Greenhouse Projects		
Chemical Safety		
Greenhouse Safety		
Shop Projects		
Basic Shop Safety		
Welding Safety		
Other Training		

Legal Requirements

The regulations listed below are to make the teacher aware of some of the regulations that apply to teachers and students in the California agricultural education setting. This is not presented as a complete listing, but rather as a sample.

California Education Code

The California Education code states in sections 32030-32034"

> "32030. It shall be the duty of the governing board of every school district, and of every county superintendent of schools, and of every person, firm, or organization maintaining any private school, in this state, to equip schools with eye protective devices as defined in Section 32032, for the use of all students, teachers, and visitors when participating in the courses which are included in Section 32031. It shall be the duty of the superintendents, principals, teachers or instructors charged with the supervision of any class in which any such course is conducted, to require such eye protective devices to be worn by students, teachers, or instructors and visitors under the circumstances prescribed in Section 32031.
>
> 32031. The eye protective devices shall be worn in courses including, but not limited to, vocational or industrial arts shops or laboratories, and chemistry, physics or combined chemistry-physics laboratories, at any time at which the individual is engaged in, or observing, an activity or the use of hazardous substances likely to cause injury to the eyes. Hazardous substances likely to cause physical injury to the eyes include materials which are flammable, toxic, corrosive to living tissues, irritating, strongly sensitizing, radioactive, or which generate pressure through heat, decomposition or other means as defined in the California Hazardous Substances Labeling Act. Activity or the use of hazardous substances likely to cause injury to the eyes includes, but is not necessarily limited to, the following:
>
> 1. Working with hot molten metal.
> 2. Milling, sawing, turning, shaping, cutting, grinding and stamping of any solid materials.
> 3. Heat treating, tempering, or kiln firing of any metal or other materials.
> 4. Gas or electric arc welding.
> 5. Repairing or servicing of any vehicles, or other machinery or equipment.
> 6. Working with hot liquids or solids or with chemicals which are flammable, toxic, corrosive to living tissues, irritating, strongly sensitizing, radioactive, or which generate pressure through heat, decomposition, or other means.
>
> 32032. For purposes of this article the eye protective devices utilized shall be industrial quality eye protective devices which meet the standards of the American National Standards Institute for "Practice for Occupational and Educational Eye and Face Protection" (Z87.1-1968), and subsequent standards that are adopted by the American National Standards Institute for "Practice for Occupational and Educational Eye and Face Protection."
>
> 32033. The eye protective devices may be sold to the pupils and teachers or instructors at a price that shall not exceed the actual cost of the eye protective devices to the school or governing board.

This section shall become operative January 1, 1992.

32034. The term eye protective devices as used in Sections 32030 to 32033, inclusive, shall not include prescription lenses as defined in Chapter 5.4 (commencing with Section 2540), Division 2, Business and Professions Code. Prescription lenses which meet the standards set forth in Section 32032 may be used by persons doing the work described in Item 6 of Section 32031 in a classroom under the supervision of appropriate personnel. "

Clearly this section applies to instruction in agricultural mechanics and may apply to many school farm activities.

California Occupational Safety and Health Regulations

The California Occupational Safety and Health Regulations can also be applied to facilities and working conditions since the teacher is an employee in California. Title 8 contains regulations regarding machinery, personal protection (including hearing), shop equipment, and chemicals. A brief summary of regulations that are generally applicable to agricultural education are listed below. Complete regulations can be viewed at:
http://www.dir.ca.gov/samples/search/query.htm

California Code of Regulations -- Title 8 Cal/OSHA STANDARDS
Chapter 4 Division of Industrial Safety

- Subchapter 3, Sections Compressed Air Safety Orders. Safety orders in this section would apply to those agricultural employers that include compressed air in their operation.
- Subchapter 4, Sections Construction Safety Orders. Safety orders in this section would apply only to agricultural operations that include construction jobs in their operation.
- Subchapter 5, Sections 2299-2599 Electrical Safety Orders - Low Voltage.
- Subchapter 5, Sections 2700-2974 - High Voltage
- Subchapter 7, Sections 3200-6184 General Industry Safety Orders

    - Section 3278; 3278 and 3279: Use of Ladders. This section covers the use of portable wooden and portable medal ladders.
    - Section 3380 - 3390: Personal Protective Devises and Safeguards. The information in these sections provide information about personal protective devices, including the protection of the head, eyes, face, hand, foot, etc..
    - Section 3425 Portable Hand Tools
    - Section 3426 Hand Tools
    - Section 3427 Safe Work Procedures
    - Section 3428 Operating Rules
    - Section 3436-3457 Agricultural Operations. Applies to agricultural operations. Following is a brief review of some of the regulations that apply exclusively to agriculture.
    - Section 3440 Agricultural Equipment
    - Section 3441 Operation of Agricultural Equipment
    - Section 3453: Applicator Rigs, Tanks, and Vessels Used for Fertilizer
    - Section 3456: Hand - Held Tools
    - Section 3651 Agricultural and Industrial Tractors. This section covers the provision of rollover protective structures (ROPS) and other factors related to tractors. Every

employer is to post and enforce a set of operating rules, and employee who operate an agricultural or industrial tractor shall be trained at the time of initial assignment and at least annually thereafter.

- Section 3664 Operating Rules. Covered in this section are employee operating rules including the nine (9) rules for tractor operation.
- Section 5095-5100: Hearing Protection Training. The employer shall institute a training program for all employees who are exposed to noise at or above an 8-hour time-weighted average of 85 dba. The training program shall be repeated annually. Employees will be trained in the use and care of all hearing protectors provided and employer will ensure proper initial fitting and supervise correct use of all hearing protectors.
- Section 5154 Respiratory Protective Equipment. Consists of training in the need, use, sanitary care, and limitations of such respiratory equipment as any employee may have the occasion to use. Respirators shall be inspected before each use and shall not be worn when conditions prevent a good gas-tight face seal

  The employer shall provide, repair or replace respiratory protective equipment as may be required due to wear and deterioration. Written operating procedures must be available from the employer.

  A new Respiratory Protection Standard took effect on November 23, 1998; compliance is required by May 22, 1999. The California standard is essentially the same as the Federal standard. The fed standard can be viewed on the Fed OSHA website: https://www.osha.gov/dte/library/respirators/major_requirements.html.

Legal Responsibilities as an Agricultural Education Teacher Relating To Negligence[2]

The LEGAL DEFINITION of "negligence" is important for every teacher to know. Negligence, as defined by the courts today, is conduct that falls below a standard of care established by law or profession to protect others from an unreasonable risk of harm, or the failure to exercise due care. It should be noted that in the absence of specific laws or local policies, the profession sets the standard of care expected. The technology education teacher has three basic duties relating to the modern concept of negligence:

- Duty of instruction.
- Duty of supervision.
- Duty to properly maintain facilities and equipment.

Failure to perform any duty may result in a finding that a teacher and/or administrator within a school system is/are liable for damages and a judgment awarded against him/them.

DUTY OF INSTRUCTION includes adequate instruction before a laboratory activity (preferably in writing) that:

- is accurate, is appropriate to the situation, setting, and maturity of the audience, and addresses reasonably foreseeable dangers.
- identifies and clarifies any specific risk involved, explains proper procedures/techniques to be used, and presents comments concerning appropriate/inappropriate conduct in the lab. Instruction must follow professional and district guidelines. A teacher who sets a bad example by not following proper laboratory procedures may be sued if injury results from students following the teacher's bad example.

DUTY OF SUPERVISION includes adequate supervision as defined by professional, legal and district guidelines to ensure students behave properly in light of any foreseeable dangers. Points to remember:

- Misbehavior of any type must not be tolerated.
- Failure to act or improper action is grounds for liability.
- The greater the degree of danger, the higher the level of supervision should be.
- The younger the age of students or the greater the degree of inclusion of special population students, the greater the level of supervision should be.
- Students must never be left unattended, except in an emergency where the potential harm is greater than the perceived risk to students. Even then, risk should be minimized or responsibility transferred to another authorized person if the situation allows.

DUTY OF MAINTENANCE includes ensuring a safe environment for students and teachers.

- Never use defective equipment for any reason.
- File written reports for maintenance/correction of hazardous conditions or defective equipment with responsible administrators.
- Establish regular inspection schedules and procedures for checking safety and first aid equipment.

[2] Safety Guidelines for Technology Education & Elementary Science / Technology Education. Pennsylvania Department of Education, Bureau of Curriculum and Academic Services, Division of Curriculum and Instruction

- Follow all safety guidelines concerning proper labeling, storage and disposal of chemicals.

By keeping files of all hazard notifications and maintenance inspections, teacher liability in the event of an accident is minimized in cases where no corrective actions were subsequently made.

Teacher and School Liability

We live in a litigious time. Even the most conscientious teacher may have an accident involving a student injury and a suit may be filed. Teachers are most at risk when they are negligent in providing safety instruction and a safe environment A safe environment includes the condition of the facilities and equipment as well as appropriate supervision.

In 2005 John Kessell et. al. reviewed case law in regards to career and technical education. They comment:

> "When litigation issues are discussed in education, the possibilities of right and wrong are endless. One of the key issues of any litigation factor is the aspect of liability. This is often defined and litigated as a tort action. Tort liability can be defined as a wrongful doing. The area of tort that concerns agricultural education the greatest is negligence. These actions of litigation can occur from conditions of facilities to the condition of equipment being used during labs and hands-on activities. Actions under this topic also include travel with students for professional conferences, international experiences, career development opportunities, and other state and national FFA activities. An additional area of concern lies on the liability of the institution with student teaching, internships and job shadowing.
>
> Four main questions must be asked during a tort liability charge. 1) Does the institution possess a custodial relationship to the student? 2) Was there a duty to protect from harm? 3) Was there a duty to anticipate and intervene on any wrong doing? 4) Is this the reasonable person standard, did the faculty member do what should have been done. (Kaplin & Lee, 1995).
>
> The majority of tort liability negligence proceedings in vocational and agricultural education occur within classroom and laboratory activities…. The effects of tort liability are great on an institution which has been found to be negligent. It is critical to document the instruction and use of materials and procedures to minimize the threat of negligence within the educational setting in secondary and post-secondary institutions."3

Generally Kessell found that teachers minimized their risk of being found negligent when they provided safety instruction and their teaching facilities were properly maintained (e.g. guards in place).

[3] A Historical Review of Tort Liability Verdicts Impacting Secondary Agricultural Education. John Kessell, Justin Scott, David Lawver, Steven Fraze, Texas Tech University (2005).

Reducing Youth Injury

In 2012 a study was conducted by McCurdy, Xiao and Kwan to determine participant demographic information and their agricultural related work injuries of 946 agricultural students in California. The results showed the following:

> "We observed increased injury risk among participants working on large animal operations and performing selected farm tasks, in particular feeding large animals, mixing chemicals, and welding. Tractor driving was also associated with a near doubling of odds for injury. Educational measures should include inculcating healthy safety-related attitudes and focus on hazardous tasks, such as those involving animals (for girls) and motor vehicles and machinery (for boys). Education with periodic follow-up may provide some reduction for youth injury."[4]

McCurdy at el. Showed that educational safety training and parental support/training were the major factors in reducing injuries for students in agricultural education programs.

[4] Agricultural Injury Among Rural California Public high School Students. Stephen A McCurdy, Hong Xiao, Johnathan A. Kwan, American Journal of Industrial Medicine (2102)

Managing Health and Safety, and Risk Assessment

Management systems are used to ensure that crops and animals are kept healthy, production is optimized and you to keep a functional learning environment for students. As a teacher you plan what to plant and when, assess the risks of diseases and other incidents that may detract from the success of the crop or animal, and control those problems, monitor growth, decide when to harvest, and store products in a way that ensures they do not deteriorate. You also evaluate success and decide on improvements (e.g. changing variety or pesticide treatment).

Managing health and safety is no different – you need to manage it to ensure that you, and your students and others are kept safe. The main elements to consider are:

- **Policy –** setting a policy and making sure everyone knows and understands it;
- **Organizing –** to promote a positive health and safety culture to implement the policy, and train and consult students and other workers;
- **Planning and implementing –** systems to assess and control risks;
- **Measuring performance** – systems to monitor whether standards are being met;
- **Learning from experience –** systems to review what actually happens and using any lessons learned as the basis for improvements.

Safety is everyone's responsibility. Engage your students in the process of creating a safe environment in your school setting. This promotes personal responsibility and builds a culture of safety.

The Teachers' Responsibility[5]

The **major** responsibility for laboratory safety instruction and accident prevention falls on the teacher. The following are considered to be part of the responsibilities of the teacher in a comprehensive accident prevention program for agricultural education.

1) NOTE: DO NOT LEAVE THE FACILITIES UNSUPERVISED AT ANY TIME WHEN STUDENTS ARE PRESENT.
2) The teacher should emulate (model) safe practices and techniques at all times.
3) Incorporate safety instruction in the course of study and maintain documentation as to who received instruction and when instruction was given.
4) Present instruction on potential hazards and accident prevention specific to the particular school laboratory.
5) Instigate a comprehensive safety program for your particular school laboratory.
6) Develop specific safe practices, rules and regulations relating to your facilities and provide for their enforcement.
7) Keep informed of new and accepted safe practices for accident prevention.
8) Provide proper instruction for the use of all tools, machines and equipment. Keep a record of each student's attendance, safety training and safety evaluation.
9) Require that a student be enrolled in the agricultural education program and receive the required safety instruction prior to working in the laboratory.
10) Insist that adequate eye protection be worn in all technology education laboratories at all times in accordance with California Education Code Sections 32030-32034 found in this document.
11) Insist on proper protective equipment in all laboratory areas and require students to wear proper clothing, eye protection and adequate hair guards while working in the laboratory. Generally leather closed toed shoes are required.
12) Remove and/or secure all jewelry while working in the laboratory.
13) Devise and enforce safe housekeeping procedures.
14) Insist that guards meeting accepted standards be provided and used whenever a machine is operated.
15) Establish and maintain the safest possible working environment.
16) Have set, pre-planned procedures in case of an accident or emergency.
17) Provide prompt and thorough reports of accidents including:
    a) Written report by instructor.
    b) Written accounts by witnesses.
    c) Photographs of accident scene and conditions.
18) Always provide for the supervision of students in the shop, school farm, or other laboratory setting in accordance with legal requirements.
19) Regularly review laboratory facilities to maintain safe conditions. Give special attention to these items:
    a) Layout
    b) Utilities and building services
    c) Equipment guarding

[5] Adapted from Safety Guidelines for Technology Education & Elementary Science / Technology Education. Pennsylvania Department of Education, Bureau of Curriculum and Academic Services, Division of Curriculum and Instruction

d) Storage and conditions of tools
e) Storage, labeling and handling of materials

20) Submit written recommendations to the administration for improving safety conditions.
21) Review all IEP's on a regular basis to address the needs of all students enrolled in all agricultural education classes.
22) Criteria for scheduling special needs students into laboratory classes should be established by a team of counselors, technology education teachers, special education teachers and school administrators. Aides or special equipment should be made available to the technology education teacher. This should also include the appropriateness of placement of the student.

Communication of Safety to Parents/Guardians[6]

For years, technology education teachers have used "permission slips" that were sent home and signed by the parents/guardians permitting their child to participate in the laboratory. Many teachers believed that these "policy statements" relieved them of some or all of their responsibilities and liability should an accident occur. **IT DOES NEITHER OF THESE**. The purpose of this type of communication is to:

- **Inform** the parent/guardian of his/her child's participation in the activity.
- **Outline** the safety instruction and procedures followed by the teacher and the district.
- **Obtain** from the parent/guardian relevant information regarding any health problems having a bearing on the child's performance.
- **List** the parent/guardian's telephone number(s) where he/she can be reached during school hours and list the name of the family doctor.

[6] Adapted from Safety Guidelines for Technology Education & Elementary Science / Technology Education. Pennsylvania Department of Education, Bureau of Curriculum and Academic Services, Division of Curriculum and Instruction

Sample Letter to Parents

Safety in Agriculture Education

Sunny Valley School District
Mr. Jones, Agriculture Instructor

Sunny Valley High School
(530)-555-1212
bjones@svsd.k12.ca.us

To the parent or guardian of _____,
Your son/daughter is enrolled in our agricultural education program and will have the opportunity to use various tools and equipment either in the shop or on the school farm. Appropriate instruction in their safe operation is given and close supervision is maintained at all times. Although every precaution is taken to prevent accidents, a certain risk is involved due to the nature of the experience, the age of the student, and the learning environment. We are asking you to impress upon your child the importance of being careful. We believe this will support the instruction that is given in school. You are invited to visit our school and the agricultural program. These visits can be arranged by calling _____
Thank you very much for your help and assistance in providing your son/daughter with the "hands-on" experience of agriculture in a safe working environment. Please complete this form and return to your child's teacher.

I have read the attached communication and I understand the type of program that my child is enrolled in. I will stress the safety aspects of this program to my child. I will encourage my child to participate fully in his/her agricultural education program.

_____ _____
Parent or guardian date

_____ _____
home phone work phone

Please identify any health problems that may have a bearing on your child's participation in this class.

_____
_____
_____
_____

I agree to observe all safety rules and procedures for safe operation and conduct in the school agricultural education program and will wear approved eye protection at all times while in the shop or other areas where eye protection is required in accordance with state law.

_____ _____
Student date

SDS

When working with any type of chemical the Safety Data Sheet (SDS) should be posted in a conspicuous place in the work area. SDS binders are available for this purpose. Teachers should review the SDS for all materials used in the shop or farm and be familiar with any hazards that may be associated with use of the materials. If a material does pose a health hazard teachers should observe appropriate precautions when they or their students handle the material.
As of June 1, 2015 The Hazard Communication Standard (HCS) requires chemical manufacturers, distributors, or importers to provide Safety Data Sheets (SDSs) (formerly known as Material Safety Data Sheets or MSDSs) to communicate the hazards of hazardous chemical products.[7]
16 Standardized SDS Sections:

1. Identification
2. Hazard(s) Identification
3. Composition/Information on Ingredients
4. First-Aid Measures
5. Fire-fighting Measure
6. Accidental Release Measures
7. Handling and Storage
8. Exposure Controls/Personal Protection
9. Physical and Chemical Properties
10. Stability and Reactivity
11. Toxicology Information
12. Ecological Information
13. Disposal Considerations
14. Transport Information
15. Regulatory Information
16. Other Information

Common materials that require SDS sheets are:

Gasoline and other fuels	Pesticides
Welding rod	Cleaners
Welding gases	Other petroleum products
Paint	Adhesives (e.g. PVC Cement)
Solvents	Portland Cement
Fertilizer	Lead acid and rechargeable power tool batteries

SDS are available from product manufacturers (see their web sites) and also can be found at:
https://www.msdsonline.com/resources/ghs-answer-center/ghs-101-safety-data-sheets-sds
For additional information regarding SDS requirements please visit the website below:
https://www.osha.gov/Publications/OSHA3514.html

Key pages of a SDS for gasoline is shown below.

[7] Occupational Safety & Health Administration (OSHA) Quickcard. Hazard Communication Safety Data Sheets.

SAFETY DATA SHEET

SDS ID NO.: 0127MAR019
Revision Date: 06/01/2016

1. IDENTIFICATION

Product Name: Marathon Petroleum Gasoline - All Grades

Synonym: Gasoline; Regular Unleaded Gasoline; Conventional Regular Unleaded Gasoline; Mid Grade Unleaded Gasoline; Conventional Mid Grade Unleaded Gasoline; Premium Unleaded Gasoline; Conventional Premium Unleaded Gasoline; Sub-Octane Gasoline; Regular RBOB; Super RBOB; Premium RBOB; RBOB; Reformulated Blend Stock For Oxygenated Blending; 84 Octane Gasoline; CBOB; Premium CBOB; Conventional Blend Stock for Oxygenate Blending; Recreational Gasoline; Recreational Gasoline; Recreational Unleaded Gasoline; 89 Recreational Gasoline; Brand 89 Recreational Gasoline; 7.0 Max RVP 89 Recreational Gasoline; BR 7.0 Max RVP 89 Recreational Gasoline; 90 Recreational Gasoline; 90 Marina Gasoline; Brand 91 Recreational Gasoline; 91 Recreational Gasoline; 91 Marina Gasoline; 90 Octane Midgrade Gasoline with No Ethanol; 0125MAR019; 0126MAR019; 0134MAR019; 0313MAR019; 0314MAR019

Chemical Family: Complex Hydrocarbon Substance

Recommended Use: Fuel.
Restrictions on Use: All others.

Manufacturer, Importer, or Responsible Party Name and Address:
MARATHON PETROLEUM COMPANY LP
539 South Main Street
Findlay, OH 45840

SDS information: 1-419-421-3070

Emergency Telephone: 1-877-627-5463

2. HAZARD IDENTIFICATION

Classification

OSHA Regulatory Status
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Flammable liquids	Category 1
Skin corrosion/irritation	Category 2
Germ cell mutagenicity	Category 1B
Carcinogenicity	Category 1B
Reproductive toxicity	Category 2
Specific target organ toxicity (single exposure)	Category 3
Aspiration toxicity	Category 1
Acute aquatic toxicity	Category 2
Chronic aquatic toxicity	Category 2

Hazards Not Otherwise Classified (HNOC)

Static accumulating flammable liquid

Label elements

EMERGENCY OVERVIEW

Danger

EXTREMELY FLAMMABLE LIQUID AND VAPOR
May accumulate electrostatic charge and ignite or explode
May be fatal if swallowed and enters airways
Causes skin irritation
May cause respiratory irritation
May cause drowsiness or dizziness
May cause genetic defects
May cause cancer
Suspected of damaging fertility or the unborn child
Toxic to aquatic life with long lasting effects

Appearance Clear yellow liquid **Physical State** Liquid **Odor** Hydrocarbon

Precautionary Statements - Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep container tightly closed
Ground/bond container and receiving equipment
Use explosion-proof electrical/ventilating/lighting/equipment
Use only non-sparking tools.
Take precautionary measures against static discharge
Avoid breathing mist/vapors/spray
Use only outdoors or in a well-ventilated area
Wear protective gloves/protective clothing/eye protection/face protection
Wash hands and any possibly exposed skin thoroughly after handling
Avoid release to the environment

Precautionary Statements - Response
IF exposed or concerned: Get medical attention
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
If skin irritation occurs: Get medical attention
Wash contaminated clothing before reuse
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor if you feel unwell
IF SWALLOWED: Immediately call a POISON CENTER or doctor
Do NOT induce vomiting
In case of fire: Use water spray, fog or regular foam for extinction
Collect spillage

Precautionary Statements - Storage
Store in a well-ventilated place. Keep container tightly closed
Keep cool
Store locked up

Precautionary Statements - Disposal
Dispose of contents/container at an approved waste disposal plant

3. COMPOSITION/INFORMATION ON INGREDIENTS

Gasoline is a complex combination of hydrocarbons consisting of paraffins, cycloparaffins, aromatic and olefinic hydrocarbons having molecular chains ranging in length from four to ten carbons. May contain small amounts of dye and other additives (>0.02%) which are not considered hazardous at the concentrations used.

Composition Information:

Name	CAS Number	% Concentration
Gasoline	86290-81-5	100
Heptane (mixed isomers)	142-82-5	2.5-26
Pentane (mixed isomers)	78-78-4	6.5-19
Butane (mixed isomers)	106-97-8	0.5-14
Hexane Isomers (other than n-Hexane)	107-83-5	2-12
Toluene	108-88-3	3-9.5
Xylene (mixed isomers)	1330-20-7	3.5-9.5
n-Hexane	110-54-3	0.1-4.5
Cumene	98-82-8	0-4
1,2,4 Trimethylbenzene	95-63-6	1-4
Ethylbenzene	100-41-4	0.5-2.5
Benzene	71-43-2	0.1-1.5
Cyclohexane	110-82-7	0-1.5
Octane	111-65-9	0-1.5
1,2,3-trimethylbenzene	526-73-8	0-1
Naphthalene	91-20-3	0.1-0.5

All concentrations are percent by weight unless material is a gas. Gas concentrations are in percent by volume.

4. FIRST AID MEASURES

First Aid Measures

General Advice: In case of accident or if you feel unwell, seek medical advice immediately (show directions for use or safety data sheet if possible).

Inhalation: Remove to fresh air. If not breathing, institute rescue breathing. If breathing is difficult, ensure airway is clear, give oxygen and continue to monitor. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). Keep affected person warm and at rest. If symptoms occur get medical attention.

Skin Contact: Immediately wash exposed skin with plenty of soap and water while removing contaminated clothing and shoes. May be absorbed through the skin in harmful amounts. Get medical attention if irritation persists. Any injection injury from high pressure equipment should be evaluated immediately by a physician as potentially serious (See NOTES TO PHYSICIAN).

Place contaminated clothing in closed container until cleaned or discarded. If clothing is to be laundered, inform the person performing the operation of contaminant's hazardous properties. Destroy contaminated, non-chemical resistant footwear.

Eye Contact: Flush immediately with large amounts of water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Gently remove contacts while flushing. Get medical attention if irritation persists.

Ingestion: Do not induce vomiting because of danger of aspirating liquid into lungs, causing serious damage and chemical pneumonitis. If spontaneous vomiting occurs, keep head below hips, or if patient is lying down, turn body and head to side to prevent aspiration and monitor for breathing difficulty. Never give anything by mouth to an unconscious person. Keep affected person warm and at rest. GET IMMEDIATE MEDICAL ATTENTION.

Most important signs and symptoms, both short-term and delayed with overexposure

Adverse Effects: Irritating to the skin and mucous membranes. Symptoms may include redness, itching, and inflammation. May cause nausea, vomiting, diarrhea, and signs of nervous system depression: headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue. Aspiration hazard. May cause coughing, chest pains, shortness of breath, pulmonary edema and/or chemical pneumonitis. Repeated or prolonged skin contact may cause drying, reddening, itching and cracking.

Indication of any immediate medical attention and special treatment needed

Notes To Physician: INHALATION: This material (or a component) sensitizes the myocardium to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals exposed to this material. Administration of sympathomimetic drugs should be avoided.

SKIN: Leaks or accidents involving high-pressure equipment may inject a stream of material through the skin and initially produce an injury that may not appear serious. Only a small puncture wound may appear on the skin surface but, without proper treatment and depending on the nature, original pressure, volume, and location of the injected material, can compromise blood supply to an affected body part. Prompt surgical debridement of the wound may be necessary to prevent irreversible loss of function and/or the affected body part. High pressure injection injuries may be SERIOUS SURGICAL EMERGENCIES.

INGESTION: This material represents a significant aspiration and chemical pneumonitis hazard. Induction of emesis is not recommended.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media
For small fires, Class B fire extinguishing media such as CO2, dry chemical, foam (AFFF/ATC) or water spray can be used. For large fires, water spray, fog or foam (AFFF/ATC) can be used. Firefighting should be attempted only by those who are adequately trained and equipped with proper protective equipment.

Unsuitable extinguishing media
Do not use straight water streams to avoid spreading fire.

Specific hazards arising from the chemical
This product has been determined to be an extremely flammable liquid per the OSHA Hazard Communication Standard and should be handled accordingly. May accumulate electrostatic charge and ignite or explode. Vapors may travel along the ground or be moved by ventilation and ignited by many sources such as pilot lights, sparks, electric motors, static discharge, or other ignition sources at locations distant from material handling. Flashback can occur along vapor trail. For additional fire related information, see NFPA 30 or the Emergency Response Guidebook 128.

Hazardous combustion products
Smoke, carbon monoxide, and other products of incomplete combustion.

Explosion data
Sensitivity to Mechanical Impact No.
Sensitivity to Static Discharge Yes.

Special protective equipment and precautions for firefighters
Firefighters should wear full protective clothing and positive-pressure self-contained breathing apparatus (SCBA) with a full face-piece, as appropriate. Avoid using straight water streams. Water may be ineffective in extinguishing low flash point fires, but can be used to cool exposed surfaces. Avoid excessive water spray application. Water spray and foam (AFFF/ATC) must be applied carefully to avoid frothing and from as far a distance as possible. Keep run-off water out of sewers and water sources.

Additional firefighting tactics
FIRES INVOLVING TANKS OR CAR/TRAILER LOADS: Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Cool containers with flooding quantities of water until well after the fire is out. Do not direct water at source of leak or safety devices; icing may occur. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles: if this is impossible, withdraw from area and let fire burn.

EVACUATION: Consider initial downwind evacuation for at least 1000 feet. If tank, rail car or tank truck is involved in a fire, ISOLATE for 5280 feet (1 mile) in all directions; also, consider initial evacuation of 5280 feet (1 mile) in all directions.

NFPA	Health 1	Flammability 3	Instability 0	Special Hazard -

6. ACCIDENTAL RELEASE MEASURES

Personal precautions:	Keep public away. Isolate and evacuate area. Shut off source if safe to do so. Eliminate all ignition sources.
Protective equipment:	Use personal protection measures as recommended in Section 8.
Emergency procedures:	Advise authorities and National Response Center (800-424-8802) if the product has entered a water course or sewer. Notify local health and pollution control agencies, if appropriate.
Environmental precautions:	Avoid release to the environment. Avoid subsoil penetration. Ethanol in gasoline phase seperates in contact with water. Monitor downstream for dissolved ethanol or other appropriate indicators.
Methods and materials for containment:	Contain liquid with sand or soil. Prevent spilled material from entering storm drains, sewers, and open waterways.
Methods and materials for cleaning up:	Use suitable absorbent materials such as vermiculite, sand, or clay to clean up residual liquids. Recover and return free product to proper containers. When recovering free liquids ensure all equipment is grounded and bonded. Use only non-sparking tools.

7. HANDLING AND STORAGE

Safe Handling Precautions:

NEVER SIPHON THIS PRODUCT BY MOUTH. Use appropriate grounding and bonding practices. Static accumulating flammable liquid. Bonding and grounding may be insufficient to eliminate the hazard from static electricity. Do not expose to heat, open flames, strong oxidizers or other sources of ignition. Vapors may travel along the ground or be moved by ventilation. Flashback may occur along vapor trails. No smoking. Use only non-sparking tools. Avoid contact with skin, eyes and clothing. Avoid breathing fumes, gas, or vapors. Use only with adequate ventilation. Avoid repeated and prolonged skin contact. Use personal protection measures as recommended in Section 8. Exercise good personal hygiene including removal of soiled clothing and prompt washing with soap and water. Do not cut, drill, grind or weld on empty containers since explosive residues may remain. Refer to applicable EPA, OSHA, NFPA and consistent state and local requirements.

Hydrocarbons are basically non-conductors of electricity and can become electrostatically charged during mixing, filtering, pumping at high flow rates or loading and transfer operations. If this charge reaches a sufficiently high level, sparks can form that may ignite the vapors of flammable liquids. Sudden release of hot organic chemical vapors or mists from process equipment operating under elevated temperature and pressure, or sudden ingress of air into vacuum equipment may result in ignition of vapors or mists without the presence of obvious ignition sources. Nozzle spouts must be kept in contact with the containers or tank during the entire filling operation.

Portable containers should never be filled while in or on a motor vehicle or marine craft. Containers should be placed on the ground. Static electric discharge can ignite fuel vapors when filling non-grounded containers or vehicles on trailers. The nozzle spout must be kept in contact with the container before and during the entire filling operation. Use only approved containers.

A buildup of static electricity can occur upon re-entry into a vehicle during fueling especially in cold or dry climate conditions. The charge is generated by the action of dissimilar fabrics (i.e., clothing and upholstery) rubbing across each other as a person enters/exits the vehicle. A flash fire can result from this discharge if sufficient flammable vapors are present. Therefore, do not get back in your vehicle while refueling.

Cellular phones and other electronic devices may have the potential to emit electrical charges (sparks). Sparks in potentially explosive atmospheres (including fueling areas such as gas stations) could cause an explosion if sufficient flammable vapors are present. Therefore, turn off cellular phones and other electronic devices when working in potentially explosive atmospheres or keep devices inside your vehicle during refueling.

High-pressure injection of any material through the skin is a serious medical emergency even though the small entrance wound at the injection site may not initially appear serious. These injection injuries can occur from high-pressure equipment such as paint spray or grease or guns, fuel injectors, or pinhole leaks in hoses or hydraulic lines and should all be considered serious. High pressure injection injuries may be SERIOUS SURGICAL EMERGENCIES (See First Aid Section 4).

Storage Conditions:

Store in properly closed containers that are appropriately labeled and in a cool, well-ventilated area. Do not store near an open flame, heat or other sources of ignition.

Incompatible Materials

Strong oxidizing agents.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Name	ACGIH TLV	OSHA PELS:	OSHA - Vacated PELs	NIOSH IDLH
Gasoline 86290-81-5	300 ppm TWA 500 ppm STEL	-	300 ppm TWA 900 mg/m³ TWA 500 ppm STEL 1500 mg/m³ STEL	-

Heptane (mixed isomers) 142-82-5	400 ppm TWA 500 ppm STEL	TWA: 500 ppm TWA: 2000 mg/m³	400 ppm TWA 1600 mg/m³ TWA 500 ppm STEL 2000 mg/m³ STEL	750 ppm
Pentane (mixed isomers) 78-78-4	1000 ppm TWA	-	-	-
Butane (mixed isomers) 106-97-8	1000 ppm STEL	-	800 ppm TWA 1900 mg/m³ TWA	-
Hexane Isomers (other than n-Hexane) 107-83-5	500 ppm TWA 1000 ppm STEL	-	500 ppm TWA 1800 mg/m³ TWA 1000 ppm STEL 3600 mg/m³ STEL	-
Toluene 108-88-3	20 ppm TWA	TWA: 200 ppm Ceiling: 300 ppm	100 ppm TWA 375 mg/m³ TWA 150 ppm STEL 560 mg/m³ STEL	500 ppm
Xylene (mixed isomers) 1330-20-7	100 ppm TWA 150 ppm STEL	TWA: 100 ppm TWA: 435 mg/m³	100 ppm TWA 435 mg/m³ TWA 150 ppm STEL 655 mg/m³ STEL	900 ppm
n-Hexane 110-54-3	50 ppm TWA Skin - potential significant contribution to overall exposure by the cutaneous route	TWA: 500 ppm TWA: 1800 mg/m³	50 ppm TWA 180 mg/m³ TWA	1100 ppm
Cumene 98-82-8	50 ppm TWA	TWA: 50 ppm TWA: 245 mg/m³ Skin	50 ppm TWA 245 mg/m³ TWA Limit applies to skin	900 ppm
1,2,4 Trimethylbenzene 95-63-6	25 ppm TWA	-	25 ppm TWA 125 mg/m³ TWA	-
Ethylbenzene 100-41-4	20 ppm TWA	TWA: 100 ppm TWA: 435 mg/m³	100 ppm TWA 435 mg/m³ TWA 125 ppm STEL 545 mg/m³ STEL	800 ppm
Benzene 71-43-2	0.5 ppm TWA 2.5 ppm STEL Skin - potential significant contribution to overall exposure by the cutaneous route	TWA: 10 ppm (applies to industry segments exempt from the benzene standard) TWA: 1 ppm STEL: 5 ppm (see 29 CFR 1910.1028)	25 ppm Ceiling 1 ppm TWA 5 ppm STEL	500 ppm
Cyclohexane 110-82-7	100 ppm TWA	TWA: 300 ppm TWA: 1050 mg/m³	300 ppm TWA 1050 mg/m³ TWA	1300 ppm
Octane 111-65-9	300 ppm TWA	TWA: 500 ppm TWA: 2350 mg/m³	300 ppm TWA 1450 mg/m³ TWA 375 ppm STEL 1800 mg/m³ STEL	1000 ppm
1,2,3-trimethylbenzene 526-73-8	25 ppm TWA	-	25 ppm TWA 125 mg/m³ TWA	-
Naphthalene 91-20-3	10 ppm TWA Skin - potential significant contribution to overall exposure by the cutaneous route	TWA: 10 ppm TWA: 50 mg/m³	10 ppm TWA 50 mg/m³ TWA 15 ppm STEL 75 mg/m³ STEL	250 ppm

Notes: The manufacturer has voluntarily elected to provide exposure limits contained in OSHA's 1989 air contaminants standard in its SDSs, even though certain of those exposure limits were vacated in 1992.

Engineering measures: Local or general exhaust required in an enclosed area or when there is inadequate ventilation. Use mechanical ventilation equipment that is explosion-proof.

Personal protective equipment

Eye protection:	Use goggles or face-shield if the potential for splashing exists.
Skin and body protection:	Use nitrile rubber, Viton® or PVA gloves for repeated or prolonged skin exposure. Glove suitability is based on workplace conditions and usage. Contact the glove manufacturer for specific advice on glove selection and breakthrough times.
Respiratory protection:	Use a NIOSH approved organic vapor chemical cartridge or supplied air respirators when there is the potential for airborne exposures to exceed permissible exposure limits or if excessive vapors are generated. Observe respirator assigned protection factors (APFs) criteria cited in federal OSHA 29 CFR 1910.134. Self-contained breathing apparatus should be used for fire fighting.
Hygiene measures:	Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes and clothing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical State	Liquid
Appearance	Clear yellow liquid
Color	Yellow
Odor	Hydrocarbon
Odor Threshold	No data available.

Property	**Values (Method)**
Melting Point / Freezing Point	No data available.
Initial Boiling Point / Boiling Range	24-210 °C / 75-410 °F (ASTM D86)
Flash Point	-43 °C / -45 °F
Evaporation Rate	No data available.
Flammability (solid, gas)	Not applicable.
Flammability Limit in Air (%):	
Upper Flammability Limit:	7.6
Lower Flammability Limit:	1.4
Explosion limits:	No data available.
Vapor Pressure	5.5-15 psi (ASTM D4814)
Vapor Density	3-4
Specific Gravity / Relative Density	0.70-0.76
Water Solubility	No data available.
Solubility in other solvents	No data available.
Partition Coefficient	2.13-4.5
Decomposition temperature	No data available.
pH:	Not applicable
Autoignition Temperature	280 °C / 536 °F
Kinematic Viscosity	No data available.
Dynamic Viscosity	No data available.
Explosive Properties	No data available.
VOC Content (%)	100%
Density	No data available.
Bulk Density	Not applicable.

10. STABILITY AND REACTIVITY

Reactivity	The product is non-reactive under normal conditions.
Chemical stability	The material is stable at 70°F, 760 mmHg pressure.
Possibility of hazardous reactions	None under normal processing.
Hazardous polymerization	Will not occur.

Hazardous Material Storage

Commercial fertilizers, petroleum products, and pesticides and other products may be stored in shops or on school farms. Potentially poisonous, corrosive, volatile, flammable or dangerous materials or liquids must be stored in structurally sound facilities to prevent leaks and spills. Storage of these materials could consider physical security as well as the hazard they might pose in the event of a fire or earthquake.

Agricultural Chemical Storage

All agricultural chemicals should be stored in a dedicated facility. Minimum standards dictate that a storage structure must:

- be ventilated naturally or mechanically to the outdoors to prevent the accumulation of toxic or flammable vapors
- be accessible from outdoors and secured from unauthorized entry
- have an impervious floor, typically concrete, without a floor drain and curbed to contain a volume at least equal to the largest container stored within
- be separated from all food, feed and water supplies
- be separated from all other occupancies either by an open space or by a fire separation wall having a fire rating resistance of at least one hour
- be clearly identified with a sign saying “Danger”, “Chemical Storage” or “Authorized Persons Only” permanently attached to the outside of each entrance
- contain shelving that separates oxidizing chemicals from combustible chemicals
- have an insulated and heated cabinet for chemicals requiring protection from freezing

If a storage structure is incorporated with a sprayer filling station, it should be located well away from and sloped away from any surface water courses or groundwater supply sources. It should be situated on land that is naturally impermeable or has been covered with an artificial impermeable base.

Storage and Disposal of Used Containers

A storage facility should be dedicated to the storage of full and partially full containers only. Empty containers should be triple-rinsed or cleaned to the point where they pose no threat to people, animals or the environment. If temporary storage is required, the site selected should be one that is used infrequently and is fenced or enclosed. Check local regulations for container disposal requirements.

Disposal of Diluted Chemicals

To minimize the number of containers that must be disposed of, farmers are encouraged to calculate their chemical needs carefully. If chemicals are already mixed and contained in a sprayer, they may be further diluted and sprayed on an already sprayed crop. This eliminates the need to drain the sprayer and store used or diluted chemicals.

Recycling of Unused or Expired Chemicals

Chemicals that are not likely to be needed in the future or whose efficacy is likely to decline before they will be used again should be disposed of in an environmentally responsible manner. Unopened pesticides can be returned to the vendor. Partially full containers should be disposed of properly. Excess pesticide, whether diluted or not, should never be disposed of in an inconspicuous farm

location or drained into the sewer system. Under no circumstances should expired chemicals or incompletely washed containers be stored in an area not dedicated to pesticide storage.

Safe Use of Pesticides

Pesticides restricted by the state or federal government require application by a licensed applicator. These regulations apply to farm, landscape, and greenhouse applications. Even if you do not apply restricted chemicals it is recommend that you take the training associated with the licensing to become familiar with the safety application of and regulations associated with restricted chemicals.

Emergency Plan

An emergency plan outlining steps to be taken in the event of a spill or leak should be posted near the entrance of every facility in which agri-chemicals are stored. Each emergency plan should include information on the location of emergency and first aid equipment, emergency phone numbers, and clean-up instructions. Confer with your school to see what plan might be in place.

Spills

Many regulations exist covering the handling of hazardous material spills. Consult with local authorities to determine how spills of the hazardous materials you store need to be handled. By determining who to call ahead of time you will be better prepared if a spill occurs.

Storage of Medication

All drugs for livestock use must be stored in accordance with labeling instructions to maintain its efficacy. Specific instructions on temperature and exposure to light will be noted on all labels. Organized storage will help to prevent inadvertent use of a wrong product.

Storage of Petroleum Products

Appropriate guidelines must be followed when setting up fuel storage facilities to ensure that environmental and fire safety concerns are met. Labeling regulations vary and are dependent on sizes of fuel tanks and whether storage is aboveground or underground. Disposal of used oil products and the recycling of used petroleum is subject to regulation.

Fertilizer Storage

Liquid fertilizer storage tanks should be located within a properly-sized walled or bermed leak-proof secondary containment structure. Large dry bulk fertilizer storages should be sited on elevated ground with all rain, snow melt or flood water diverted away. Fertilizers must be kept dry in well-constructed facilities to prevent caking and consolidation. Extra care must be practiced when impregnating fertilizers with pesticides.

Hazardous Wastes

Hazardous waste includes such materials as batteries, paint, and unused chemicals. Many regulations exist covering the handling of hazardous waste. Consult with local authorities (often counties have disposal programs) to determine how the hazardous waste you generate can be disposed of properly. Use recycling programs when ever possible.

Hazardous Chemical Storage Guidelines

Introduction

Chemical storage is regulated by the Environmental Protection Agency (EPA), The Uniform Fire Code (UFC), The National Fire Protection Association (NFPA), and the Occupational Health and Safety Administration (OSHA). There are two major categories of stored materials - toxic materials and materials not classified as toxic. Within each of these categories, materials are segregated into seven other groups: acids and bases, flammable/combustible materials, oxidizers, organic peroxides, water reactive materials, explosives/unstable materials, and other. Chemicals should be stored in cabinets. In school shop settings common chemicals that fall under these regulations are fuels, paints, and solvents. NOTE: the SDS will always identify the type of the chemical and its properties.

Cabinet Requirements

Cabinets should meet the following requirements:

- Each cabinet should be labeled with the contents of the cabinet.
- Each cabinet should be clearly labeled as to the hazard class of the materials stored within the cabinet (e.g., Acids, Flammables, etc.).
- Each cabinet must be rated for use with the hazard class of the most hazardous content stored.
- No paper products, office equipment, food, or any other non-hazardous material should be stored in any hazardous material storage cabinet.
- The cabinet must be listed with an approved testing laboratory (UL, FM, etc.) for the intended use.
- Cabinet capacities shall not exceed those given in the following table.

Storage Capacity Limits for Flammable Materials

Class I Flammable Liquid	Flash Point less than 100° F	60 gallons or less per cabinet
Class II Combustible	Flash Point less than 140° F. but greater than or equal to 100° F	60 gallons or less per cabinet
Class III Combustible	Flash Point greater than or equal to 140° F	120 gallons or less per cabinet
Combination		120 gallons (no more than 60 gallons of Class I or II)

No more than three flammable storage cabinets (60-gallon capacity) are permitted in one fire area unless extra cabinets are separated from the first group of cabinets by 100 feet or more.

Welding Gases

Compressed gases such as oxygen, carbon dioxide, argon, and acetylene are commonly found in shops. Cylinders in use must be restrained by non-flammable restraints (e.g. chain) at the base and upper 1/3 of the cylinder. Gas must be stored in ventilated areas.

The follow excerpts from the "Safe Handling of Compressed Gases" published by the Compressed Gas Association, Inc. are good guidelines for proper compressed gas handling and storage:

3. Safe Handling Rules for Cylinders of Compressed Gases (*)
The rules of this section apply generally to the handling of all cylinders containing compressed gases. References to other publications giving additional handling precautions for specific gases are listed in Section 6.

3.1.9 Where the user is responsible for the handling of the cylinder and connecting it for use, such cylinders should carry a legible label or stencil identifying the content. See American Standard Method of Marking Portable Compressed Gas Containers to Identify the Material Contains, Z48.1(3) **,** and CGA Pamphlet C-7, "A Guide to the Preparation of Labels for Compressed Gas Containers."(4)

3.2.3 Never drop cylinders nor permit them to strike against each other or against other surfaces violently.

3.2.5 Avoid dragging or sliding cylinders. It is safer to move cylinders even short distances by using a suitable truck.

3.2.6 Use suitable hand truck, fork truck, roll platform or similar device with cylinder firmly secured for transporting and unloading.

3.3.8 Protect cylinders from any object that will produce a cut or other abrasion in the surface of the metal. Do not store cylinders near elevators or gangways, or in locations where heavy moving objects may strike or fall on them.

3.3.10 Cylinders should be protected against tampering by unauthorized individuals.

3.4.4 Before using cylinder, be sure it is properly supported to prevent it from being knocked over.

3.5.3 *Do not store reserve stocks of cylinders containing flammable gases with cylinders containing oxygen. They should be segregated. Inside of buildings, stored oxygen and fuel gas cylinders should be separated by a minimum of 20 feet, or there should be a fire-resistive partition between the oxygen and fuel gas cylinders. This is in accordance with NFPA Standard No. 51. "Gas Systems for Welding and Cutting."* (6)

3.7.1 ICC specification cylinders containing pressurized liquid oxygen, nitrogen or argon must be transported, stored, and used in an upright position. These materials are maintained at extremely low temperatures, and cylinders must be kept upright to permit venting of vapor periodically to maintain safe internal pressures.

(*)Rules pertaining to the storage and handling of cylinders apply with equal force to the storage and handling of spheres and drums where the alternate use of these containers is authorized by ICC Regulations.
(3)"American Standard Method of Marking Portable Compressed Gas Containers to Identify the Material Contained," Z48.1 - CGA Pamphlet C-4 available from Compressed Gas Association, Inc. 500 Fifth Avenue, New York, N.Y. 10036 and American Standards Association, Inc., 10 East 40th Street, New York, N.Y. 10016.
(4)"A Guide to the Preparation of Labels for Compressed Gas Containers" - Pamphlet C-7, available from Compressed Gas Association, Inc. 500 Fifth Avenue, New York, N.Y. 10036.
(6)"Gas Systems for Welding and Cutting" - NFPA Standard No. 51, published by National Fire Protection Association, 60 Batterymarch Street, Boston, MA 02110.

Facility Safety Checklists

These are some quick and easy checklists to evaluate your lab, shop and/or farm. Checklists can be used for periodic inspections by the teacher or as part of a classroom exercise (often called a "Hazard Hunt").

Teachers are encouraged to adapt these to suit their own needs. Common changes would be to combine parts of two or more checklists, remove sections that don't apply, or add sections for specific situations such as a farm feed mill or a harvester.

Shop Checklist[8]

	Pass	Fail	N/A
General Shop			
Safety glasses are required.			
Hearing protection is provided for use of tools exceeding 85 db.			
Aisles are properly indicated, and aisles, passageways and corridors are free of obstructions.			
Exit signs are visible and directional exit signs provided. Exit signs have letters 6" high, 3/4" strip and 5 candlepower illumination.			
A fire alarm is provided.			
Exit doors and access to exits are not locked from exit side.			
Condition of floors maintained in a clean and dry condition and free from obstructions and debris.			
Ventilation is proper and adequate for the lab.			
Fire extinguishers of proper types, adequate1y located and maintained (tested yearly). Maximum height 5', if under 40#, 3 1/2' if over 40#.			
• Class A fire - wood, paper, cloth and rubber-foam and dry chemical recommended			
• Class B fire - flammable liquid, gas, and grease - dry chemical, CO2 and foam recommended			
• Class C fire - energized electrical – dry chemical & CO2 recommended			
• Class D fire - combustible metals specific for the chemical			
Non-exit doors are clearly identified "not an exit" or otherwise labeled for use.			
Every opening, floor or platform 4 ft. or more above ground level has a standard guard rail 42" high with an intermediate rail and a toe board of at least 4 in. above the floor. Rail must withstand 200# thrust.			
All stairways having more than four (4) risers have a standard hand railing 30" – 34” high.			
All gears, moving belts, chains, and shafts, etc., are protected by permanent guards.			
All stationary power tools are anchored to the floor.			
Illumination is adequate. Good shadow-free lighting is required -- 30 foot-candles (fc) general area, 50 fc on work areas, 100 fc for delicate repair work.			
A trained person (or persons) is available to render first aid.			
First aid supplies approved by the health department and readily available.			
Fire blankets are readily available.			
Battery charging area will provide facilities for flushing and neutralizing			

[8] Adapted from Planning, Organizing, and Teaching Agricultural Mechanics. Bear and Hoerner, Hobar Publications. 1986

electrolyte.			
Respirators are provided in dusty areas.			
Face shields are provided at every power tool.			
Safety lanes are provided around power and non-powered stationary tools-			
Non-skid surfaces provided at power tools on smooth floors.			
Bump hats or hard hats are available for appropriate applications.			
Toe guards are available for appropriate applications.			
Approved first aid supplies are readily available.			
Washing facilities are provided and properly maintained.			
Restroom facilities are provided if not readily available.			
A keyed master disconnect switch for all power tools.			
Safety areas are marked around stationary tools.			
Stationary machines are arranged so that individuals are protected from hazards of other machines.			
Tools are kept sharp, clean, and in good working order.			
Drill presses are equipped with clamps or vises.			
Shears are shielded.			
Materials Storage			
Pressure safety cans are used for flammable or combustible liquids.			
Combustible wastes are kept in covered metal containers.			
A fire resistive cabinet is used to store flammable liquids.			
Stored wood and metal are stacked safely and solidly so they will not fall.			
SDS sheets are available and clearly marked for all materials found in the shop. (For example, welding gas, fuel, welding rod.)			
Ladders			
All ladders are in good repair and stored properly. Ladders not exposed to elements, heat and dampness, hung horizontally,			
All portable ladders have safety feet.			
All fixed ladders meet design specifications. Rung to back clearance - 7 in., max. rung spacing - 12 in., caged if more than 20 ft. to a max. of 30 ft.			
Electrical			
Electrical cabinets and power room is accessible only to authorized personnel.			
Circuit breakers and disconnects are clearly labeled.			
All electrical receptacles, junction boxes and switch boxes are properly covered.			
All electrical outlets and fixtures are grounded.			
All stationary power tools and equipment are grounded.			
All extension cords are grounded. Cords of J wire grounding type.			
Portable power tools are grounded or tools are double insulated. .			
All electrical disconnects are identified (circuit breakers, fuse boxes, etc.) in boxes.			
The signal units for heating, ventilating and air-conditioning are			

operational.			
Overcurrent devices are provided on all electrical loads.			
Hoists			
Safety hooks are used on all chains and lifting devices.			
Rated load plainly marked on the side of lifting equipment.			
Stands are provided to block raised equipment.			
Compressed Air			
Compressed air plumbing is steel or copper (L or M) not PVC.			
Hoses are in good condition.			
Air used for cleaning is regulated to not more than 30 psi and chip guarded.			
Safety valve in the air line is in good working order.			
There are pressure gauges on the air lines.			
Air compressor is drained frequently.			
Air compressor fans and flywheels within 7 ft. of the floor are guarded with a guard having holes not greater than 1/2 in. in width. Compressor is placarded as “automatic equipment”.			
Woodworking Equipment			
Saw blades and cutterheads are sharp and in good condition.			
Push sticks or push blocks are available.			
The table saw is equipped with a hood, guard, anti-kick back and spreader.			
The band saw has an adjustable guard above the blade rolls and the blade wheels are covered.			
The jointer has a working automatic guard covering all sections of the cutting head.			
Power miter saw is in good working condition. Guards work smoothly. Saw is secured to a bench or stand.			
The radial arm saw is equipped with hood guard, anti-kickback, rotation sign, automatic return, and table extension or stop.			
All saws have roller units or stands to assist moving material to the saw and removal after cutting.			
Grinders			
The grinder has a safety guard at the point of operation.			
The grinder has guards to cover the spindle ends, nuts and flanges.			
The work rests are adjusted to within 1/8 inch of the grinding wheel.			
The adjustable tongue guard or spark deflector on grinder is adjusted to within 1/4" of the grinder wheel.			
Maximum periphery exposure for a stationary grinder is 65 degrees. (Exposed distance between tool rest and tongue guard or spark deflector.)			
Grinding wheel of the right type and in good condition with no cracks, wheel diameter over half -of original size.			
Cooling container nearby and filled.			
Wheel dresser available.			

All portable grinders and saws have proper shielding in position. Power cords in good condition.			
The forge or small furnace is adequately vented.			
Arc Welding			
Adequate ventilation is provided for the dissipation of exhaust gases and welding fumes.			
Arc welder cables are not worn or damaged.			
Electrode holders are in proper condition to avoid exposure to electrical connections.			
Electrode holders are hung up and so placed and fastened securely to the cable that they do not make electrical contact.			
Arc welding helmets with tempered safety glass of the proper shade are in good condition.			
• Shielded metal-arc welding (SMAW)1/16 - 5/32 electrodes No.10			
• TGAW 1/16 - 5/32 electrodes No. 11-12			
• Gas-shielded ferrous arc welding (GMAW) 1/16 -5/32 No. 12			
• Carbon arc. No. 14			
Fire resistant curtains or shields are used around arc welding areas or booths.			
The floor in the welding area is kept dry and free of combustible aterials.			
Protective gloves are provided and are in good condition.			
Protective clothing such as jackets, sleeves, or capes are provided for out of position welding.			
Shade 3-5 goggle or face shields are provided for plasma cutting.			
Compressed Gas Storage			
Compressed gas cylinders are chained or secured in place.			
The protective cap is in place on all stored cylinders.			
Combustible compressed gas and oxygen cylinders are separated by at least 20 ft. or a 5 ft. high wall of 1/2 hr. heat barrier.			
Gas Welding			
Portable gas welding equipment has the cylinder valves turned off when not in use.			
Gas welding goggles with tempered safety glass of the proper shade are in good condition.			
• Torch brazing No.3 or 4			
• Light cutting to 1 in. No.3 or 4			
• Gas welding (light) up to 1/8 in. No.4 or 5			
• Gas welding (med.) 1/8 - 1/2 in. No.5			

Oxyacetylene manifold welding systems have been installed according to the N.F.P.A. Shut off valves are working.			
Dress			
Rings and other jewelry are removed when working in the shop.			
All clothing worn is free from loose sleeves, flopping ties, loose coats. etc.			
Long hair is tied back.			
Shoes cover feet (closed toe). Leather is required for welding.			
Paint			
Paint spray booth has adequate ventilation.			
Paint spray booth has proper lighting.			
Explosion proof wiring within 20 feet of spray paint booth.			
No open flames within 20 feet of opening of spray paint booth.			
Spray paint area not littered with combustible materials.			

Machinery (Tractor) Checklist

Make	Model

	Pass	Fail	N/A	Comments
Mechanical Inspection				
Engine Oil				
Transmission/Hydraulic Oil				
Brake Oil (if separate from hydraulic oil)				
Oil Leaks				
Coolant Level				
Fuel level, Filler Cap				
Air Cleaner valve and pre-cleaner clear				
Radiator screen clear				
Tire inflation and condition				
Left and Right brakes have same travel				
Three point hitch and sway chains.				
Drawbar (firmly attached, fixed for road travel, free for field operations)				
Hitch pins secured by safety (Lynch) pins				
Deck free of oil and debris				
Electrical wiring properly insulated and tied down				
Steering connections tight				
Safety Equipment				
Seat belt installed and useable if ROPS equipped				
PTO shields in place				
SMV sign attached				
Head lights operational				
Turn Signal/Hazard lights working (if equipped)				
Turn/hazard lights operational				

Other Hazards (list):

_____
_____
_____
_____
_____

Inspected by: _____ Date: _____

Barn / Farm Building Inspection Checklist[9]

	Yes	No	N/A
Are emergency phone numbers (fire station, policy station, EMS) listed and posted in a prominent location? Is an unlocked phone available when students are working in the facility?			
Is the building free of unnecessary accumulations of trash, litter, junk, and other things that could start or fuel a fire?			
Are working and walking areas free for debris that could cause a slip or fall?			
Is the building free from any highly flammable liquid such as gasoline?			
Are stairs and permanent ladders in good condition?			
Do stairs have handrails?			
Are stairs clear of objects and slippery substances?			
Are passageways clear of tools, buckets, or slippery substances that could cause falls?			
Are protrusions such as nails removed from walls or railings to prevent contact?			
Is the building properly lighted, especially in common work areas?			
Does electrical wiring appear to be in good condition?			
Can the main electrical power source be locked out if necessary?			
Are portable equipment power cords in good condition?			
Are materials and supplies stored and secured so as to not present a falling object hazard?			
Is power equipment properly shielded? Are shields in place during equipment operation?			
Are "head-bumpers" such as low ceilings, beams, low doors, and hanging objects marked with warnings?			
Are doors and gates to hazardous areas (silos, manure storage, chemical storage, animal quarters, etc.) kept closed and secured to keep out unsupervised students and visitors?			
Are the correct size and type of fire extinguishers mounted at building entrances and exits?			
Are exit doors clearly marked?			
Are toxic products locked up out of reach of students (including livestock drugs)?			

Other Hazardous Conditions:

_____

_____

Inspected by: _____ Date: _____

[9] Adapted from: CONDUCTING FARM SAFETY INSPECTIONS by David W. Smith, Extension Safety Program. Texas A&M. Available at: http://agsafety.tamu.edu/files/2011/06/CONDUCTING-FARM-SAFETY-INSPECTIONS1.pdf

Livestock Facilities Checklist[10]

	Yes	No	N/A
Are feeding, grinding, and materials handling equipment properly shielded and all shields in place when used?			
Are loading chutes on augers, elevators, and conveyors covered with grating?			
Are animal medicines kept in a secure area stored in the original containers?			
Are electrical stock water heaters grounded?			
Are all heat lamps for farrowing and brooding well secured and placed at least two feet from combustible materials?			
Are animal working pens free from sharp projections such as nails and metal objects that might endanger animals or workers?			
Are head gates and animal confinement equipment in good working condition?			
Are fences free of splinters, protruding nails, and sharp edges?			
Are gates secure and free of pinch points?			
Are walking surfaces in work areas and passageways kept clear of manure, mud, and spilled grain?			
Are all electrical outlets in animal handling area properly covered, protected from moisture, and equipped with ground fault circuit interrupters (GFCIs)?			
Are there at least two exits from each area used for working livestock?			
Have milking parlor steps and walkways been roughened to prevent slips and falls?			
Are ventilation fans and vents in confinement housing in good working condition?			
Is newly stored hay monitored for the possibility of overheating?			
Are barn chemicals, fly sprays, disinfectants, or medications kept in their original containers and stored out of the reach of children?			

Other Hazardous Conditions:

_____

_____

_____

_____

Inspected by: _____ Date: _____

[10] Adapted from: CONDUCTING FARM SAFETY INSPECTIONS by David W. Smith, Extension Safety Program. Texas A&M. Available at: http://agsafety.tamu.edu/files/2011/06/CONDUCTING-FARM-SAFETY-INSPECTIONS1.pdf

Greenhouse Facilities Checklist

Electrical panels covered	Yes	No	N/A
All electrical junction boxes are covered			
Outlets are waterproof			
Outlets are protected by GFCI circuits (shock hazards)			
Extension cords are grounded and in good conditions			
Pesticides and chemicals are in locked storage with waterproof shelves			
All chemicals are clearly labeled			
Eye wash supplies/station are available and clearly marked			
Pesticide application logs are kept and easily accessible			
SDS sheets are available and clearly marked for all materials			
Personal Protective Equipment (PPE) is provided (see chemical safety)			
Aisles are kept clear			
Facility is free of trip hazards such as hoses and electrical cords			
Walkways are non skid (not slippery)			
Fans and other equipment are well guarded			
Fire extinguishers are available, easily located, serviced annually			
Compressed gas cylinder are properly stored (restrained)			
Shade cloth is fire resistant and 3 feet from all combustible sources like fan motors and heaters			

Other Hazardous Conditions:

_____

_____

_____

_____

Inspected by: _____ Date: _____

Student Incident Report

Student: Date of incident:

Course: Period: Time:

1. Describe, in detail, how the incident occurred:

   _____

   _____

   _____

   _____

   _____

2. What was the nature of the injury?

   _____

   _____

   _____

3. To whom did you report the incident? _____
4. Who witnessed the incident? _____
5. What First Aid treatment did you receive at the school? _____
6. Were you treated by a doctor? _____
7. What is the name of your family doctor? _____
8. Upon reflection, how could this incident have been prevented?

   _____

   _____

   _____

   _____

Student's signature:_____ Date: _____

Staying healthy

Health problems in agriculture can develop unnoticed, unlike the effects of an injury which will usually be noticed quickly. You can best protect your health by being aware of the risks and reporting illness as soon as you become aware of it.

This section deals with zoonoses, avoiding ill health from veterinary medicines, skin and chest problems.

Zoonoses

Diseases passed to humans from animals are known as zoonoses. Micro-organisms such as bacteria, virues, parasites and fungi can cause illness by infecting the body when they penetrate the skin (through small cuts for example).

- Decide what you need to do to prevent or control exposure;
- Minimize the risk of infection by keeping stock healthy. Vaccinate where appropriate (e.g. against enzootic abortion of ewes);
- Avoid or if this is not possible, reduce contact with animals where practicable;
- Ensure good personal hygiene. Wash before eating, or drinking;
- Wear suitable protective clothing such as overalls when handling animals, especially if they are sick, and gloves and a waterproof apron if handling possibly infected material such as products of birth or muck and sewage;
- Wash and cover immediately all cuts and grazes.

Consult you vet on likely zoonoses from your animal, but note that common ones include;

- Orf from sheep or goats: produces painful pustules on hands, arms and face;
- Leptosirosis from rats (Weil's disease) and cattle urine: causes a feverish illness with headache and can result in meningitis. Early treatment is vital;
- Ringworm: a fungal disease from many types of livestock;
- Enzootic abortion (chlamydia psittaci) from sheep: pregnant women should not associate or work with ewes during lambing, nor be exposed to contaminated clothing or other sources of infection, as severe illness and miscarriage may result;
- Cryptosporidiosis: from a parasite picked up by touching livestock, animal housing, or feed, which can cause diarrhea in humans, and be particularly severe in young children;
- Ornithosis (another form of chlamydia psittaci) from birds: can cause flu-like symptoms in humans followed by pneumonia.

Illness following infection by the *E coli 0157* bacterium may be severe and even fatal. Any ruminant (cattle, sheep, goats, and deer) may carry the organism, which can survive from many weeks in feces or soil. Good personal hygiene is essential.

Chest problems

The main causes of chest problems are dust or chemicals you use, or which you may be in contact with, at work. These can cause unpleasant irritation or inflammation in the nose, throat or lungs. Some may cause more serious allergy and ill health, such as asthma and bronchitis. Chest problems may result from breathing in:

- Dust from harvesting or handling grain, mixing animal feedstuff, feeding animals, handling moldy hay or bedding in closed buildings used for intensive animal rearing (especially pigs and poultry), and waste products from animals or poultry;
- Vapors (including fumes, gases and aerosols) from slurry, silage, welding fumes, some veterinary medicines and disinfectants such as phenols and glutaraldehyde.

Warning signs include irritation / watering of the eyes and nose, blocking stuffy nose, sore throat, cough with or without phlegm, aching muscles or fever after work with moldy hay, breathlessness, tightness of the chest during work, after work or while doing exercise you could normally cope with, and wheezing.

These symptoms can be short-lived at the time of a job, or they may get worse and last longer until they are almost always present. They can be set off by even very small exposures to any substance to which you have become allergic, or sensitized. If you smoke, and are also exposed to these substances, you are more likely to develop more serious chest problems.

It is important to protect yourself and students, and for most products that you buy, advice will be available on the manufacturer's label or data sheet. Take the following precautions.

Avoid breathing in the harmful substances by:

- Using alternative substances where possible;
- Changing to low dust materials, e.g. granules / pellets;
- Enclosing sources of dust or spray;
- Vacuuming spillages instead of sweeping up–using a high efficient filter.

Reduce the amount you breathe in by:

- Using local exhaust ventilation, e.g. when welding;
- Using effective filters in tractor / vehicle cabs;
- Maintaining filters to manufacturer's requirements;
- Improving ventilation in building;
- Wearing effective respiratory protective equipment. Make sure you use the appropriate mask or respirator for dusts, vapors or aerosols.

If you need to wear masks or respirators always adjust the straps so they fit properly. Store them in a clean dry place–do not hang them from hooks or nails in dirty, dusty areas.

Veterinary Medicines

All medicines should be stored securely, where students cannot get at them. Make sure syringes and needles are stored securely. If veterinary medicines are misused they can cause ill health, so when you are your veterinarian have decided that you must treat the animal, consider:

- Less hazardous products, e.g. a water-based vaccine instead of an oil-based one, or a non-organo-phosphorus (OP) product rather than an OP. Remember to consider the environment as well as human health and safety;
- Using a safer application system, e.g. a pour-on or injectable rather than a dip;
- Engineering controls, e.g. splash screens around dip bath, or shrouded needles;
- What training is needed to safely use the product? Special rules apply to sheep dips;
- How you plan to dispose of the product, e.g. sheep dips that contain OP compounds are potentially more hazardous to humans than non-OP alternatives. However non-OP dips pose a greater hazard to aquatic life, so dispose of any dip properly – not into watercourses or soak ways.

Always:

- Wash off splashes from the skin and clothing immediately, and wash before eating, drinking or smoking. Don't work among freshly treated animals if you could be contaminated;
- Follow any emergency measures recommended by the manufacturer – eg with oil-based vaccines;
- Report all suspected cases of poisoning – than they can be thoroughly investigated.
- Always follow the label instructions.

Personal Protective Equipment (PPE)[11]

Personal protective equipment (PPE) should be the last line of defense. Before considering the use of PPE, first try to eliminate or minimize the risks through other means—for example, by using less hazardous chemicals or by modifying work processes or equipment. If PPE is required ensure that it is available to all workers who need it. All workers should be trained in the use of any relevant PPE. The following table lists various types of PPE and their uses.

Body Part	Type of PPE	Uses
Eyes	Safety glasses	General eye protection
	Safety goggles and face shield	Working with chemicals that may splash or where flying debris could cause injury
Ears	Hearing protection	Working around equipment
Hands	Work gloves	Working in storage areas, handling garbage, or landscaping
	Chemical-resistant gloves	Cleaning with or handling chemicals (check MSDSs for specific glove requirements)
	Cut-resistant gloves	Using chainsaws, handling glass, pruning, or cleaning equipment
Feet	Non-slip footwear	Working in and around greenhouses
	Steel-toed boots	Operating mobile equipment and working in storage areas
	Footwear with ankle support	Working outdoors
Lungs	Respirators	Protection against gas and vapor contaminants, particulate contaminants, or oxygen deficiency
Legs	Cut-resistant leggings	Working with chainsaws
Body	Fall protection equipment	Working at heights

[11] Adapted from Health and Safety for Greenhouses and Nurseries. Available at http://www.worksafebc.com/publications/high_resolution_publications/assets/pdf/SB10.pdf

Safety Instruction

Many textbooks contain sections on safe use of tools and equipment. The following pages are organized by tool and may be used for specific instruction. This list is by no means comprehensive, but does cover topics commonly applicable to agricultural education programs.

Safety Instructions are grouped into common areas and sample tests are available for selected topics. Instructors are encouraged to adapt these materials for their own programs.

Environmental Horticulture Safety Topics

Greenhouses

1. Do not work in the greenhouse alone.
2. Wear closed-toe footwear.
3. Do not drink water from any hoses or faucets in the greenhouses.
4. Always wash hands after working and before eating, drinking.
5. In the event of lightning, hail or high winds, immediately leave the greenhouse for a more secure structure.
6. In the event of a fire, immediately evacuate the greenhouse, set off the fire alarm and notify the authorities. Polycarbonate/acrylic greenhouse coverings are extremely flammable and the fumes are hazardous.
7. Know the locations of fire alarms and fire extinguishers.
8. Many of the tools used in the greenhouse are sharp. Use with caution.
9. The greenhouse floors can become slippery when wet. Algae on floors is very slippery. Propagation areas usually have some algae. Stay on the rubber mats when possible. You may need to treat the floors to reduce algae growth.
10. Be careful when using the rolling benches to not pinch fingers and damage plant material. Also, the benches are very sharp on the corners. Please be careful.
11. Wear safety glasses when working with chemicals, pruning, and using machinery.
12. If dealing with electricity in the greenhouse, be careful. Make sure that it is well-grounded and the extension cords are adequate to carry the current. Avoid using electrical equipment when floors are wet or near moisture pads.
13. Fans are properly guarded.

Herbicide Safety[12]

1. To protect yourself and others, follow all safety precautions on the label. Know and observe the general rules for safe pesticide use, and record the date, time, location, and amount of each pesticide used.
2. Make sure that you are familiar with current federal and state pesticide laws and regulations.
3. Avoid drift of spray or dust that may endanger other crops or animals. Cover feed pans, troughs, and watering tanks in livestock areas; protect beehives.
4. Wear protective clothing and use protective equipment according to instructions on the pesticide label.
5. Never eat or drink while applying pesticides.
6. Avoid spilling spray materials on skin or clothing. If such an accident occurs, wash immediately with soap and water.
7. Bathe after applying pesticides and change into freshly laundered clothing. Wash clothing after applying pesticides, keeping in mind that, until laundered, such clothing must be handled according to the same precautions as the pesticide itself. Wash pesticide-contaminated clothing apart from other laundry, and take care in disposing of the wash water.
8. Do not store herbicides with other pesticides; avoid the danger of cross-contamination.
9. Be sure to properly dispose of herbicide containers according to your states regulations.
10. If you suspect poisoning, contact your nearest Poison Control Center, hospital emergency room, or physician. Take the herbicide label and, if possible, the SDS sheet with you and give it to the attending physician.

[12] Adapted from Penn state Extension University. Available at http://extension.psu.edu/pests/weeds/control/introduction-to-weeds-and-herbicides/safe-herbicide-use

Pesticide Safety[13]

Pesticides can get into your body many different ways and can have both acute and chronic effects on your health. Pesticides can make you sick by moving into your body through your skin, mouth, eyes, or your lungs as you breathe.

1. Read the pesticide label.
2. Be very cautious of concentrated pesticides before they are mixed with water.
3. Always wear Personal Protection Equipment (PPE).
    a. Protecting your Eyes:
        i. You must wear eye protection when you mix, load, or apply pesticides; clean or repair equipment; or flag for an aerial application.
        ii. Types of eye protection can be safety glasses (with temple and brow protection), goggles, a face shield, or a full-face mask. Pilots can use a visor for eye protection. Regular eyeglasses and sunglasses DO NOT provide enough protection.
    b. Protecting your Hands:
        i. Keeping pesticides off your hands is often the hardest part of working safely with pesticides. Once a pesticide gets on your hands, it can get in your eyes if you rub them, or in your mouth if you touch your food. Always wash your hands before eating, drinking or going to the bathroom.
        ii. You must wear gloves when you mix, load, or apply pesticides; clean or repair pesticide application equipment; during all hand applications of pesticides; and anytime the label says so. If the label does not say what type of glove you need, you must use gloves made of chemical-resistant material like rubber or neoprene. Never wear fabric-lined or leather gloves unless the label specifically says you may.
        iii. In a few cases, a pesticide label may tell you not to wear gloves. If it does, do not wear them.
    c. Protecting your Lungs:
        i. You must wear a respirator while using pesticides that are harmful if you breathe them (this can include fumigants, powders, dusts, and some liquids), anytime the pesticide label requires one, or if you are mixing, loading or applying pesticides.
        ii. Protecting your Body:
        iii. You must wear clean coveralls (or a long-sleeved shirt and long pants) every day that you work with pesticides with either the word DANGER or WARNING on the label.
        iv. If the pesticide label states that you should wear chemical-resistant clothing and equipment than you MUST do so while mixing, loading and applying pesticides.
4. Always wash your hands off with soap and water after pesticide use.

[13] Adapted from CA Department of Pesticide Regulation. Available at http://www.cdpr.ca.gov/docs/whs/pdf/hs2.pdf

What can pesticide labels tell me?

Most labels have a special word in capital letters on the front of the label. It tells you what the acute health hazard is.
The words you might see are:

- **DANGER,** this pesticide is extremely harmful.
- **WARNING**, this pesticide is moderately harmful.
- **CAUTION**, this pesticide is slightly harmful, but still can make you sick.

If the label doesn't have one of these words, it means that the pesticide is less likely to harm you. However, you should handle every pesticide carefully.

Pressure Washer[14]

Read and understand operator's manual.

1. Wear appropriate PPE.
2. Inspect powered equipment, and report any defects or necessary repairs.
3. Wear slip-resistant footwear.
4. Never point the nozzle at anyone, even if the water is turned off.
5. Use both hands to operate the pressure washer.
6. Maintain a body position that gives you the greatest control over it.
7. Don't use a pressure washer while standing on a ladder.
8. Don't let pressure washer spray come in contact with electrical devices or wiring.

Pruning Safety Precautions[15]

1. Wear appropriate personal protective equipment, including safety glasses with side shields, hard hat, gloves, long-sleeved shirt, long pants, boots, and sunscreen.
2. Never prune trees or branches within 10 feet of power lines. Contact your local utility company to secure appropriately qualified tree trimming services.
3. Maintain a safe working distance from other people when using pruning tools or equipment.
4. Carefully inspect the work area to locate any signs of bees, wasps, or other potential animal hazards.
5. Do not attempt to cut branches bigger than the pruning tool was designed to cut.
6. Before making a cut, always know the location of your hands and fingers.
7. Do not purposefully drop pruning tools from ladders.
8. Always carry pruning tools with the sharp end pointed down.
9. Prior to dropping a branch, an audible warning such as "timber" should be given.
10. Take frequent breaks when performing repetitive tasks. Do not overtire yourself.
11. Be aware of the weather conditions and drink adequate fluids to prevent heat illness.
12. Never use electric pruning tools or equipment when it is raining or in wet conditions.

String and Blade Trimmers[10]

Read and understand operator's manual.

1. When the trimmer is not in use, keep the cutter guard on.
2. Use trimmers at ground level only.
3. Turn off the engine before setting the cutter down or performing any maintenance on it.
4. Maintain a safe distance from other people.

[14] Adapted from Health and Safety for Greenhouses and Nurseries. Available at http://www.worksafebc.com/publications/high_resolution_publications/assets/pdf/SB10.pdf

[15] Adapted from Master Gardener Program Thinking Safe and Green. Available at http://safety.ucanr.edu/files/3105.pdf

Cleaning Greenhouse Glass[10]

1. Avoid working at height if possible (for example, use a mechanical washing system).
2. Make sure no work is being done under a roof that is being cleaned from above.
3. Wear snug-fitting clothing and slip-resistant footwear.
4. Never walk the length of a gutter without wearing fall protection.
5. Take only essential tools and equipment onto the greenhouse roof.

Ergonomic Lifting[10]

1. Assess whether you will need help from another person or whether you will need a dolly, forklift, or hoist to move heavy or awkward objects.
2. Get close to the object. Avoid reaching.
3. Bend at your hips and knees.
4. Lift smoothly and slowly, keeping the object close to your body.
5. Pivot by moving your feet instead of twisting your back.
6. When carrying large items, be sure you can see where you are going.
7. When storing equipment or supplies, place the heaviest items between knee and chest levels.

Ergonomic Pushing and Pulling[10]

1. Use a dolly or handcart to move heavy loads.
2. Maintain the wheels on carts in good working order.
3. Reduce the weight or size of the load.
4. Push rather than pull whenever possible.
5. Keep floors or the ground free of debris if possible.
6. Use appropriate footwear to avoid slipping or skidding while pushing or pulling.

Heat Stress[16]

Introduction:

Working in hot environments and doing heavy physical work can affect the body's cooling system and lead to heat stress. Early symptoms of heat stress can result in serious accidents.

Factors that affect your risk of heat stress include:

- Your physical condition
- Weather conditions, especially temperature and humidity
- Environmental conditions (for example, direct sun, breezes, and shade)
- The physical demands of the work being done
- How much and the type of clothing you have on

Safety tips:

- Avoid working alone in a hot environment.
- Acclimatize your body (gradually expose yourself to heat and work).
- Drink plenty of water (one glass every 20 minutes).
- Wear clean, light-colored, loose-fitting clothing made of breathable fabric.
- Take rest breaks in a cool or well-ventilated area. Take more breaks during the hottest part of the day or when doing hard physical work. Allow your body to cool down before beginning again.
- Schedule work to minimize heat exposure. Do the hardest physical work during the coolest part of the day.

Recognizing heat stress:

- Feeling unwell, headache, or nausea
- Decreased efficiency, coordination, and alertness
- Increased irritability
- Light-headedness or dizziness
- Fainting
- Swelling of hands, feet, and ankles, usually one to two days after first exposures

Treating heat stress:

If a student exhibits or reports early signs or symptoms of heat stress, take action:

- Remove student from the hot environment to rest in a cool place and drink cool water.
- If a student has fainted, have them rest with his or her legs and feet elevated.
- Have the student assessed by the first aid attendant, if available, or by a physician.
- Keep the student under observation until he or she has fully recovered from the effects of the heat. If there is any doubt about their condition, obtain medical advice.

[16] Adapted from Health and Safety for Greenhouses and Nurseries. Available at http://www.worksafebc.com/publications/high_resolution_publications/assets/pdf/SB10.pdf

Edger

Read and understand operator's manual.

1. Do not remove safety equipment/shields from unit.
2. Wear shoes (not sandals) and required goggles, earplugs, etc.
3. Keep hands and feet away from moving parts.
4. Do not make operating adjustments while machine is running.
5. Do not operate equipment in an unsafe manner.
6. Do not operate equipment when there is a danger to bystanders.
7. Check oil/fuel levels before operating.
8. Check belts for excessive wear (contact technician).
9. Clean dirt, grass, etc. from machine before garaging.
10. Technician will make height adjustments if necessary.
11. Report any broken or unsafe equipment to technician.
12. Do not operate equipment deemed unsafe.

Power Mower (Riding)

Read and understand operator's manual.

1. Do not remove safety equipment/shields from unit.
2. Wear shoes (not sandals) and required goggles, earplugs, etc.
3. Keep hands and feet away from moving parts.
4. Do not make operating adjustments while machine is running.
5. Do not operate equipment in an unsafe manner.
6. Do not operate equipment when there is a danger to bystanders.
7. Check oil/fuel levels before operating.
8. Check belts for excessive wear (contact technician).
9. Clean dirt, grass, etc. from machine before garaging.
10. Technician will make height adjustments if necessary.
11. Report any broken or unsafe equipment to technician.
12. Do not operate equipment deemed unsafe.
13. Remain seated during operation of machine.

Power Mower (Walk)

Read and understand operator's manual.

1. Do not remove safety equipment/shields from unit.
2. Wear shoes (not sandals) and required goggles, earplugs, etc.
3. Keep hands and feet away from moving parts.
4. Do not make operating adjustments while machine is running.
5. Do not operate equipment in an unsafe manner.
6. Do not operate equipment when there is a danger to bystanders.
7. Check oil/fuel levels before operating.
8. Check belts for excessive wear (contact technician).
9. Clean dirt, grass, etc. from machine before garaging.
10. Technician will make height adjustments if necessary.
11. Report any broken or unsafe equipment to technician.
12. Do not operate equipment deemed unsafe.

Rototiller

Read and understand operator's manual.

1. Do not remove safety equipment/shields from unit.
2. Wear shoes (not sandals) and required goggles, earplugs, etc.
3. Keep hands and feet away from moving parts.
4. Do not make operating adjustments while machine is running.
5. Do not operate equipment in an unsafe manner.
6. Do not operate equipment when there is a danger to bystanders.
7. Check oil/fuel levels before operating.
8. Check belts for excessive wear (contact technician).
9. Clean dirt, grass, etc. from machine before garaging.
10. Technician will make height adjustments if necessary.
11. Report any broken or unsafe equipment to technician.
12. Do not operate equipment deemed unsafe.

Chain Saw

Read and understand operator's manual.

1. Personal Safety:
   a. Use safety footwear, snug-fitting clothing and eye, hearing and head protection.
   b. Wear non-slip gloves to improve your grip. Do not wear scarves, jewelry, or neckties which could be drawn into the engine or catch on the chain or underbrush.
   c. Always hold the chain saw with both hands when the engine is running. Use a firm grip with thumbs and fingers encircling the chain saw handle.
2. Guard Against Kickback:
   a. Hold the chain saw firmly with both hands. Don't overreach. You cannot maintain good control of the saw if you cut above shoulder height.
   b. Don't let the nose of the guide bar contact a log, branch, the ground or any other obstruction. Keep the anti-kickback device properly mounted on the guide bar.
   c. Throttles up before letting the chain contact the wood. Do all cutting at full throttle.
   d. Keep the chain sharp. Don't operate with a loose chain. Maintain the correct tension of the chain as prescribed in the owner's manual.
3. Guard against the effects of a long or continuous exposure to noise
4. Never operate a chain saw when you are fatigued.
5. Keep all parts of your body away from the saw chain when the engine is running.
6. Precautions With Chain Saws:
   a. Always carry the chain saw with the engine stopped, the guide bar and saw chain to the rear, and the muffler away from your body. When transporting your chain saw, use the appropriate guide bar scabbard.
   b. Always use caution when handling fuel. Move the chain saw at least 10 feet (3m) from the fueling point before starting the engine.
   c. Keep the handles dry, clean and free of oil or fuel mixture.
   d. Before you start the engine, make sure the saw chain is not contacting anything.
   e. Shut off the engine before setting down the saw. Do not leave the engine running unattended.
   f. Operate the chain saw only in well-ventilated areas.
   g. Never operate chain saw that is damaged, improperly adjusted, or is not completely and securely assembled. Be sure that the saw chain stops moving when the throttle control trigger is released.
7. Precautions about maintenance: Competent chain saw service personnel should perform all chain saw service. If improper tools are used to remove the flywheel or clutch, or if an improper tool is used to hold the flywheel in order to remove the clutch, structural damage to the flywheel could occur which could subsequently cause the flywheel to burst.
8. Precautions In Cutting/Work Area:
   a. Do not operate a chain saw in a tree unless you have been specifically trained to do so.
   b. Keep bystanders and animals out of the work area.
   c. Never start cutting until you have a clear work area, secure footing, and a planned retreat path from the falling tree.
   d. Use extreme caution when cutting small size brush and saplings, because slender material may catch the saw chain and be whipped toward you or pull you off balance.
   e. When cutting a limb that is under tension, be alert for spring back so that you will not be struck when the tension in the wood fibers is released.

Farm Equipment Safety Topics

Vehicle and Equipment Maintenance and Fueling[17]

Injuries can occur during vehicle or equipment maintenance. If equipment starts up unexpectedly during repairs or maintenance, workers may get caught in it, resulting in severed fingers, crushed limbs, or death. If electrical equipment is not de-energized and locked out, there is a risk of electrical shocks, burns, or electrocution. When vehicles are being fueled, there is a risk of fire, explosion, or exposure to gasoline or diesel fuel.
Before Work begins take the following steps:

Locking out equipment

1. Identify the machinery or equipment that needs to be locked out.
2. Shut off the machinery or equipment. Make sure that all moving parts have come to a complete stop. Identify and deactivate the main energy-isolating device for each energy source.
3. Apply a personal lock to each energy-isolating device for each energy source. Ensure that all parts and attachments are secured against inadvertent movement.
4. Make sure that all workers are in the clear and that no hazard will be created if the lockout is not effective, then test the lockout. After testing the “start” button, remember to hit the “stop” button again, or reset the equipment to “off.”

Fueling vehicles

1. Store fuel in a safe, secure location with the appropriate warning signage in place.
5. Use only approved fuel containers. Protect them from impacts and other damage.
6. Make sure there is a fire extinguisher nearby. Make sure it is rated for gasoline fires.
7. To avoid carbon monoxide poisoning, don’t run an engine inside an enclosed area.
8. Turn off the vehicle and let it cool before fueling.
9. Use gloves while fueling. If you get gasoline on your skin, wash immediately with soap and water.

[17] Adapted from Health and Safety for Greenhouses and Nurseries. Available at http://www.worksafebc.com/publications/high_resolution_publications/assets/pdf/SB10.pdf

Tractors

Read and understand operator's manual

1. Safety is the responsibility of the operator.
2. Use the steps and handholds provided in getting up and down from a tractor. Keep steps, pedals and footwear clean of mud and oil to avoid slips. Do not jump from a tractor or climb up and down from the rear.
3. Tractors have a high center of gravity; therefore they are easy to overturn. To avoid tipping over, reduce speed when:
   a. Making turns, especially on rough and muddy surfaces.
   b. Going across a slope.
   c. Pulling heavy or unstable loads.
4. Go up steeper slopes in reverse. Avoid slopes too steep for safe operation.
5. Avoid driving near ditches, holes, levees, trees, and electrical poles.
6. Operate the tractor smoothly, without sudden turns, stops or starts.
7. Before getting down for whatever reason, but especially for making adjustments on implements:
   a. Come to a standstill.
   b. Put the Power Takeoff in neutral.
   c. Lower the implement to the ground.
   d. Set the brakes.
   e. Turn off the motor.
   f. Put the key in your pocket.
8. Hitch implements only to the traction bar, using the recommended hitch points. Use the proper hitch pin, along with its safety pin. Attach the safety chain.
9. Sit down before starting the motor. Remain seated while driving.
10. Use the safety belt if the tractor has a Rollover Protective Structure (ROPS), so the tractor or its ROPS won't crush you if the tractor overturns.
11. Do not allow anyone to ride on the tractor, drawbar or implements.
12. Let the engine cool before checking the radiator or refueling, to avoid burns to the hands or face. Do not smoke while refueling.
13. Always keep the Power Take Off (PTO) shields in place.
14. Do not wear loose clothes, rings, or long hair, because they can get caught on the tractor, in the PTO, or the implements.
15. Use personal protective equipment when necessary: goggles, hearing protection ~~protectors~~, dust masks or respirators (for chemicals).
16. Report all mechanical problems to the repair facility, no matter how small.
17. Drive only when you are physically able to do ~~it~~ so safely.

Tractor Loader Backhoe

Read and understand operator's manual.

1. Ensure any attached equipment or accessories are correctly installed, are approved for use with the tractor, do not overload the tractor and are operated and maintained in accordance with the instructions issued by the equipment or accessory manufacturer.
2. Use an approved ROPS or safety cab and seat belt for safe operation. Overturning a tractor without a ROPS or safety cab can result in death or injury.
3. Always use the seat belt with the ROPS or safety cab.
4. Use the handholds and step plates when getting on and off the tractor to prevent falls. Keep steps and platform clear of mud and debris.
5. Do not permit anyone but the operator to ride on the tractor there is no safe place for extra riders.
6. Remember that your tractor if abused or incorrectly used can be dangerous and become a hazard both to the operator and bystanders. Do not overload or operate with attached equipment, which is unsafe, not designed for the particular task or is poorly maintained.
7. Replace all missing, illegible, or damaged safety decals.
8. Keep safety decals clean of dirt and grime.

Operating the unit:

1. Position the transmission in neutral and apply the parking brake before starting the tractor.
2. Do not start the engine or operate controls while standing beside the tractor. Always sit in the tractor seat when starting the engine or operating the controls.
3. Do not bypass the safety start switch. Use booster cables only in the recommended manner. Improper use can result in a tractor runaway.
4. A void accidental contact with the gearshift lever or power-reversing lever while the engine is running. Unexpected tractor movement can result from such contact.
5. Do not get off the tractor while it is in motion.
6. Never attach chains, ropes or cables to the loader, ROPS or backhoe for pulling purposes.
7. Never leave the tractor without first lowering the backhoe and loader buckets to the ground.
8. Stop the engine, apply the parking brake and put the gearshift lever and power-reversing lever into neutral before dismounting.
9. Do not engage the parking brake while the tractor is in motion.
10. Never leave the tractor when it is parked on an incline. Always park the tractor on level ground where possible. If the tractor is to be parked on an incline, always lower the buckets so that the cutting tips contact the ground, apply the parking brake, and securely block the wheels.
11. Always keep a lookout for bystanders.
12. Always check overhead clearance, particularly when transporting the tractor.
13. If the engine or power steering ceases operating, stop the tractor immediately.
14. Do not run the engine in a closed building without adequate ventilation, as exhaust fumes can suffocate you.
15. Always carry out the recommended checks before commencing work each day.
16. Always place the torque converter shuttle lever in neutral before operating the backhoe.
17. Do not enter the platform from the rear.
18. Always check the location of gas and electrical lines before you start to dig.
19. Watch out for overhead and underground high-voltage electrical lines when operating the loader or backhoe.
20. To prevent upsets, avoid full reach and swinging the bucket to the downhill side when operating on a slope.

21. Never operate the controls when standing on the ground.
22. Always deposit the spoil on the uphill side when operating on a slope.
23. Always travel slowly over uneven ground.
24. Take special care when excavating with a high capacity bucket.
25. Always use the recommended amount of counterweighing to ensure good stability.
26. Do not transport anyone in the loader bucket.
27. Always carry the loader bucket low for maximum stability and visibility, whether the bucket is loaded or empty.
28. Be careful when handling round objects such as oil drums, pipes or poles. Lifting too high or rolling back too far could result in these objects rolling rearward down the loader arms onto the operator.

Driving the unit:

1. Always drive with care and at speeds compatible with safety, especially when operating over rough ground crossing ditches or slopes or when turning.
2. Never allow the tractor to over-run when going downhill. Do not coast or free wheel down hills.
3. Always use the transport lock when transporting the tractor.
4. Lock the foot brake pedals together when traveling on the highway to provide two-wheel braking.
5. Do not engage the differential lock when turning the tractor. When engaged, the lock will prevent the tractor turning.
6. Always sit in the driver's seat and wear your seat belt when driving the tractor.
7. Ensure the tractor lights are adjusted to avoid blinding 'an oncoming driver.
8. Use the flasher/turn signal lights and SMV signs when traveling on public roads both day and night.
9. A void accidental contact with the gearshift lever or power reversing lever while the engine is running. Unexpected tractor movement can result.
10. Any towed vehicle whose total weight exceeds that of the towing tractor must be equipped with brakes, for safe operation.
11. When the tractor is stuck, back out to prevent upset.

Rotary Mower

Read and understand operator's manual.

1. Make sure that lock pins are installed into upper and lower link pins on hitch.
2. Add front-end weights as required to maintain enough weight on front wheels for safe steering.
3. Slow down on curves and in rough places to maintain safe steering weight on front wheels.
4. Never start or accelerate suddenly so that safe steering can be maintained.
5. Use caution when lifting implement while going up steep slopes.
6. These implements use a PTO driven driveline so:
7. Keep hands, feet, hair and clothing away from PTO shaft.
8. Disengage tractor PTO and set the brakes, turn engine off before dismounting. Always dismount from side–never over driveline.
9. Implement should not be operated unless tractor master shields, and all gear box input and output shields are in place.
10. Check proper placement of PTO shaft shield.
11. Driveline shields should turn freely by hand without PTO being engaged.
12. Ensure that u-joint yokes are locked properly onto tractor and implement shafts.
13. Look and listen for evidence of rotation.
14. Keep everyone clear when implement is being raised or lowered. Raise or lower slowly and cautiously.
15. Keep yourself and other persons clear of this machine while in operation since objects can be thrown out at a very high velocity.
16. Wear goggles or safety glasses, hearing, and dust protection while operating.
17. Check blades and blade bolts for wear and looseness daily.
18. Do not clean, lubricate, or make repairs or adjustments to this machine until PTO is disengaged, tractor is shut off, and blade carrier has stopped rotating.
19. Transport information: Before operating or moving on highways, clean off reflectors, make certain "Slow Moving Vehicle" sign is clearly visible, and install safety chain, if required. Also make sure mower is raised as high as possible.

Flail Mower

Read and understand operator's manual.

1. Observe all safety rules for tractor operation.
2. Carefully hook up three-point hitch of tractor to mower. Do not allow anyone to stand between tractor and mower.
3. Hook up PTO and check that it is properly engaged. Make sure PTO guard is in place.
4. Grease all fittings.
5. When driving down road–watch right side carefully because it extends far to right.
6. When in area to be mowed carefully adjust mower to cut as low as possible without hitting dirt.
7. Keep everyone well away from machine when it is operating because of flying objects coming from under the machine.
8. Wear proper protective equipment–goggles/safety glasses and earplugs.

Spray Rig–Ground Sprayer

Read and understand operator's manual.

1. Observe all safety rules for tractor operation.
2. Grease fittings.
3. Back up tractor to spray rigs and carefully hook up to three-point hitch. Do not allow anyone to stand between tractor and sprayer.
4. Connect PTO shaft and check that it is properly engaged with cover in place.
5. Raise tank from ground before driving forward. Damage to equipment will result if not raised.
6. Avoid overfilling to eliminate spills.
7. Wear proper spray clothing before mixing or applying spray material.
8. Triple-rinse any empty containers into spray tank.
9. Close lid and fasten properly after filling to eliminate spills.
10. When using handgun for spraying be sure it is not leaking.
11. When using booms do not allow you or others to be exposed to spray when making adjustments.
12. When finished spraying clean the spray rig thoroughly using approved methods.

Posthole Digger

Read and understand operator's manual.

1. To prevent possible personal injury during assembly, installation, operation, adjustment, or removal of the implement, it is recommended that gloves and safety glasses or face shields be worn.
2. Do not operate equipment unless guards and safety shields are in place.
3. Do not wear loose clothing or have long hair worn in a down position while operating or working around the digger.
4. Do not attempt to work around the digger with PTO shaft revolving.
5. Shut off tractor engine, set brakes and lower implement to ground before leaving tractor seat.
6. At no time will the auger be operated without tractor operator on tractor and in position to disengage PTO immediately.
7. Keep all spectators clear of auger when it is in operation.
8. Do not oil or attempt to make any adjustments while implement is in operation.
9. Do not exceed 540 rpm while operating this PTO powered implement.
10. Do not attempt to operate implement on steep hillsides.
11. Reduce speed while transporting over rough ground.
12. Keep all bolts and nuts tight. Replace any damaged or worn parts immediately.
13. When the use of hand tools is required to perform any part of assembly, installation, removal or adjustment of the implement, be sure the tools used are designed and recommended by the tool manufacturer for the specific task they will be used for.

Front End Loader

Read and understand operator's manual.

1. Always use seat belts when the tractor is equipped with a ROPS. Never use the seat belt when the tractor is not equipped with a ROPS.
2. Do not lift or carry anybody on the loader or in the bucket or attachment.
3. Never allow anyone to get under the loader bucket or reach through the lift arms when the bucket is raised.
4. Do not walk or work under the raised loader or bucket or attachment unless it is securely blocked or held in position.
5. Improper use of a loader can cause serious injury or death.
6. Operate the loader from the "Operator's Seat Only".
7. Add recommended wheel ballast or rear weight to provide good stability.
8. Move the wheels to the tractor manufacturer's widest recommended settings to increase stability.
9. Move and turn the tractor at low speeds.
10. Carry loader arms at a low position during transport.
11. Exercise caution when operating the loader with a raised loaded bucket or fork.
12. Avoid loose fill, rocks and holes. They can be dangerous for loader operation or movement.
13. Be extra careful when working on inclines.
14. Avoid overhead wires and obstacles when loader is raised. Contacting electric lines can cause electrocution.
15. Allow for the loader length when making turns.
16. Stop the loader arms gradually when lowering or lifting.
17. Use caution when handling loose or shift able loads.
18. Lower all loader hydraulic arms, stop engine and lock brakes before leaving the tractor seat.
19. Make sure all parked loaders on stands are on a hard, level surface. Engage all safety devices.
20. Operate the loader controls only when properly seated at the controls.
21. Visually check for hydraulic leaks and broken, missing, or malfunctioning parts. Make necessary repairs. Inform your repair facility.
22. Escaping hydraulic oil under pressure can have sufficient force to penetrate the skin, causing serious personal injury. If injured by escaping fluid, notify your supervisor and obtain medical treatment immediately.
23. Before disconnecting hydraulic lines, relieve all hydraulic pressure.
24. Do not tamper with the relief valve setting. The relief valve is pre-set at the factory. Changing the setting can cause overloading the loader and tractor and serious operator injury may result.
25. Using front-end loaders for handling large heavy objects, such as large round or rectangular bales, logs and oil drums is not recommended.
26. Handling large heavy objects can be extremely dangerous due to:
    a. Danger of rolling the tractor over.
    b. Danger of upending the tractor.
    c. Danger of the object rolling or sliding down the loader arms onto the operator.
27. If you must handle heavy loads, protect yourself by:
    a. Never lifting the load higher than necessary to clear the ground when moving.
    b. Ballast the tractor rear to compensate for the load.
    c. Never lifting a large object with equipment that does not have an anti-roll device.
    d. Moving slowly and carefully, avoiding rough terrain.

Fork Lift – Lift Truck

Read and understand operator's manual.

1. Before you use equipment, give your lift truck a thorough operational check. Check the oil, coolant and battery levels. Give the truck a general inspection, looking for cracked hoses or fittings.
2. Always wear a seat belt to protect you in case of a roll over.
3. Report faulty performance or damage immediately.
4. Make sure you know the load capacity of your truck and don't exceed it.
5. Always lift with the load placed squarely on the forks, with the mast vertical or tilted slightly back.
6. Tilt the elevated load forward only when directly over the unloading point, and always travel with the load as low as possible.
7. When traveling with a load, carry load as close to the floor as possible with mast tilted slightly back.
8. Never lift or lower loads while traveling.
9. Slow down at cross aisles, sharp curves, ramps, dips, and blind corners or on wet, slippery or rough surfaces.
10. Check your loads. Do not move a questionable or unsafe load. If a load looks poorly balanced, loose or too heavy check it out.
11. Always position your loads evenly on the forks for proper balance.
12. Ramps require another special technique. Always drive in reverse when you are carrying a load down a ramp or incline and look in the direction of travel.
13. Always keep the load well back against the backrest and the mast tilted backward.
14. When lifting, lowering or carrying loads keep the mast vertical or tilted back...never forward.
15. Start and stop your lift truck gradually to protect against load damage and shifting.
16. Observe speed limits and keep lift truck travel speeds slow when encountering uneven or rough surfaces.
17. Keep a safe distance between your lift truck and other lift trucks, industrial vehicles, or pedestrians working in the area.
18. Don't use your lift truck to haul riders or a load for which it was not intended.
19. Keep arms, legs and other parts of the body within the lift truck and overhead guard area.
20. When parking lift truck make sure forks are completely lowered and tilted forward slightly to keep ends against floor.
21. Park the truck in neutral, shut off the engine, set parking brake and remove ignition key.
22. Protect against accidents and damage by making sure that the load weight does not exceed floor limits, and that raised mast or overhead guard clear all overhead obstacles, water and steam pipes, eaves of building, etc.
23. Make sure your counterweight swings clear of merchandise, racks and equipment, and pedestrians when rounding corners, or maneuvering.
24. Don't allow fork tips to strike any object, and when working in areas with blind corners or aisle ways, travel in reverse if necessary.
25. Always watch for loose or poorly stacked loads, overhead obstacles and hazards, and falling objects.
26. Where applicable, wear a hard hat.
27. Do not allow riders on the lift truck.
28. Pay special attention to load swing when turning or load shifts which may upset your truck's balance.

29. Careless operation around a loading dock can mean serious injury, or damage to your equipment and merchandise.
30. Elevated loads are supported by powerful hydraulics, but play it safe. Do not walk or stand under elevated forks, or load.
31. Lift truck refueling or battery changes should take place only in a safe, designated area. Remember: one careless spark or cigarette can mean death and disaster.
32. Always apply the rules of common sense, courtesy and safety when operating lift trucks or working in lift truck area.

Skid Steer Loader[18]

Read and understand operator's manual.

1. Conduct a pre-operation safety check before entering to verify the integrity of safety devices, tires, structural components, and engine (e.g., no leaks, adequate fuel, etc.).
2. Enter the equipment only when the bucket or other attachments are on the ground, or are locked in place with lift arm supports.
3. Face the seat and keep a three point contact with the hand holds and steps.
4. DO NOT use the operating controls for handholds or steps.
5. Always wear the seatbelt when operating the equipment.

Operating the unit:

1. Immediately after starting the engine, verify the working nature of the controls, brakes, horn, and alarms.
2. Operate the loader from the operator compartment, never from the outside.
3. Never exceed the manufacturer's specified load limit. Take care to evenly distribute the load. In some cases, it may be necessary to secure the load to prevent falling or shifting.
4. Never work around the equipment when the bucket or fork attachment is raised unless it is supported and the brakes are set, and the key is removed from the ignition. Use lift arm supports when they are present on the equipment. If no supports are present, contact the equipment dealer or manufacturer for help in determining proper support procedures.
5. Never allow a person to position themselves under or near the bucket or frame while the skid steer loader is in operation.

Driving the unit:

1. Keep arms, legs, and head inside the cab when operating the loader.
2. Avoid excessive speeds.
3. Operate the equipment on stable surfaces. When possible, load, unload, and turn the equipment around on level ground.
4. For maximum stability, travel and turn equipment when the bucket is in the lowest position possible.
5. Avoid traveling across slopes and hills; if absolutely necessary, travel straight up or down with the heavy end of the machine pointed uphill.
6. Always look in the direction of travel.
7. Never allow passengers in the operator compartment or bucket of the skid steer loader.
8. Before leaving the operator's seat, set the bucket on the ground, set the parking brake, and turn off the engine.

[18] Adapted from University of Nebraska, Lincoln Environmental Health and Safety. Available at http://ehs.unl.edu/sop/s-skidsteer.pdf

ATV Safety

Read and understand operator's manual.

1. Be at least 16 years of age.
2. Always obey your state ATV laws.
3. Ensure ATV is the correct size for the riders age and weight.
4. Always wear a DOT approved helmet, gloves, eye protection, long sleeves and long pants.
5. Engine, exhaust and muffler become hot and can cause burns.
6. Attaching a whip or flags will increase visibility.
7. Keep hands and feet away from all moving parts.

Inspections

1. Inspect tires and wheels before operation.
2. Inspect controls and cables.
3. Inspect lights and ensure they work properly.
4. Check oil and fuel levels before riding.
5. If there is a chain check that it is properly lubricated.
6. If there is a drive shaft ensure that there are no leaks.

Riding

1. Never carry passengers.
2. Never ride on the road.
3. DO NOT carry or tow loads.
4. Properly shift weight when making a turn.
5. Apply brakes evenly and gently.
6. Avoid steep slopes.
7. Riding up a steep slope shift weight forward while leaving feet firmly planted on the floorboards.
8. If the ATV slides backwards on a steep incline gently apply brakes.
9. Keep feet on floorboards at all times.

Safety with Lead/Acid Batteries

1. Always wear safety glasses. Batteries contain hydrogen gas and can explode showering you with acid.
2. Batteries contain acid that will cause burns on the skin.
3. Always have baking soda on hand to neutralize spilled acid.

Battery Charging

1. Check instructions for proper settings and clamp positioning.
2. Caution: overcharging may damage battery. Also, be aware that heavy arcing at battery terminals can cause battery to explode.
3. After charging battery, turn charger off, remove cables one at a time, wipe off batteries.
4. Put all equipment back in proper location.

Proper Jump Starting with Cables

1. Must know the proper signs for positive (+) and negative (-) posts on batteries.
2. Connect to both terminals on jumper battery vehicle first.
3. Make sure that clamps are in the proper order. Positive (+) of one battery to positive (+) of the other battery. Clamp color, for example: red-to-red and black-to-black.
4. Connect one clamp to the non-ground terminal of the battery that is low. Then contact other clamp to ground, away from battery, and watch for excessive arcing.
5. Place clamp on ground terminal, keeping face away from battery.
6. Caution: heavy sparks can cause battery to explode. If heavy sparks occur, this is a sign of a problem. Recheck connections.
7. After starting, remove cables one at a time without arcing cables together.

Shop Safety Topics

Safety Instructions to Be Observed in All Shop Areas

1. Walk—do not run—in shop areas.
2. Horseplay has no place in the shop.
3. Secure permission from supervisor/instructor for special set-ups.
4. Be considerate of the safety of others.
5. Adhere to safety rules pertinent to a specific shop.
6. Do not use tools or equipment until instruction relative to safe handling has been given.
7. Persons not operating power tools or instructed to observe the operation thereof should keep clear of operators.
8. Do not stop or start a machine for another person except in an emergency.
9. Only one person will operate machines at a time.
10. Report unsafe conditions to supervisor.
11. Form correct habits under normal conditions so you will automatically do the correct thing if required to work under pressure.
12. Read and follow the precautions and information from safety posters.
13. Do not use machines for trivial operations, or when hand tools would best accomplish the task.
14. Students working in shop areas must confine their long hair and avoid wearing apparel subject to catching on or in machinery. Rings, bracelets, watches, etc. should not be worn.
15. Never throw objects in shop. Distraction or injury can result.
16. Do not tamper with adjustments or play with machinery at any time. Serious accidents can be caused by such action.
17. Do not lean on machines; you may press a switch or throw a control, which, upon starting, could endanger the safety of the operator or the machine.
18. Gloves should be worn when raw materials such as rough boards, metal subject to burrs or sharp edges, glass, or other materials in the rough are handled.
19. Eye protection is mandatory.
20. Compressed air must never be used for other than specific purposes.
21. Stop all power machinery to oil, adjust, or clean.
22. Allow revolving machinery to stop on its own. Resist the desire to grab chucks, spindles, or other rotating parts with the hand.
23. Set up shields to stop flying chips, sparks, or particles.
24. Replace grinding wheels showing cracks, those out of balance, or those worn too small to allow proper clearance (not more than 1/8”) between tool rest and stone.
25. Keep cutting tools sharp.
26. Oily rags and other highly combustible materials must be kept in a closed metal container.
27. Ground all portable and stationary power tools.
28. Keep hoses and electrical cords trip-free.
29. Never mount a grinding wheel unless the speed of the motor and the speed of the wheel are known and the two are appropriate.
30. Store flammable liquids in approved safety containers.
31. Avoid using electric drills or other electrical apparatus while standing on wet floors.
32. Make certain hands are free of oil or grease and that hammer, screwdriver, chisel, etc. handles are free of oil and grease.
33. When starting a machine, allow it to reach its proper operating RPM before using.
34. When finished with a tool, clean and replace it so it cannot fall.

35. Cords are to be disconnected when portable tools are not in use.
36. Vise handles should hang free when not in use.
37. Know and follow the specific requirements of the kind and type of machine you are going to operate.
38. Use the correct tool for the job.
39. Check for frayed electrical cords and for chafed or worn air hoses.
40. Floors are to be kept free of accumulation of materials or scrap and should be of non-skid surface.
41. The area should be swept daily and cleaned thoroughly periodically.
42. Workstations are to be closed at the end of each class period.
43. Shop area is to be neat and orderly in appearance at all times. Cluttered or dirty shops are good sites for accidents. Neat and orderly shops help eliminate unsafe working conditions.
44. Aisles should be kept clear by putting stock away promptly after using.
45. Shops should be properly ventilated. Serious disorders can be caused by uncontrolled vapors, mists, gases, and fumes.
46. Light is essential for sight. Sight is essential for safety. Keep windows, light bulbs, reflectors, and walls bright but without glare. Replace burned-out bulbs at once.
47. Fire extinguishers must be available and instructions given for proper use.
48. Fire regulations pertinent to the shop should be studied and familiar so you can assist in closing windows, make proper exit, etc.
49. Wear protective clothing and equipment. Avoid wearing anything which may be pulled into machinery.
50. Sleeves are to be kept rolled up, shirttails in, and long ties and jewelry removed. Aprons should be snugly secured.
51. A person feeling ill should not operate a machine—report to supervisor.
52. Use proper lifting techniques when moving heavy objects.
53. Report any injury to supervisor immediately.
54. Have cuts, burns, or bruises—however minor—treated immediately by the school nurse or other qualified person.
55. Neither supervisor nor employees are to treat or remove particles from the eye.
56. Eyestrain is a frequent cause of accidents. If the job subjects you to eyestrain, provide additional light.
57. Avoid placing hands to mouth or eyes while working.

General Safety Instructions for Operating Power Tools

1. Know your power tool. Read operator's manual carefully. Learn its applications and limitations as well as the specific potential hazards peculiar to this tool.
2. Ground all tools—unless double-insulated. If tool is equipped with three-prong plug, it should be plugged into a three-hole electrical receptacle. If adapter is used to accommodate two-prong receptacle, the adapter wire must be attached to a known ground. (Usually the screw secures the receptacle cover plate.) Never remove third prong.
3. Keep guards in place and in working order.
4. Keep work area clean. Cluttered areas and benches invite accidents.
5. Avoid a dangerous environment. Do not use power tool in damp or wet locations. Keep the work area well lighted.
6. Keep children away. All visitors should be kept safe distance from work area.
7. Store idle tools. When not in use, tools should be stored in a dry, high, or locked place.
8. Don't force a tool. It will do the job better and safer at the rate for which it was designed.
9. Use the right tool. Do not force a small tool or attachment to do the job of a heavy-duty tool.
10. Wear proper apparel. Wear no loose clothing or jewelry to get caught in moving parts. Rubber gloves and footwear are recommended when working outdoors.
11. Use safety glasses with most tools. Also face or dust mask should be used if cutting operation is dusty.
12. Do not abuse cords. Never carry tool by its cord or yank the cord to disconnect the tool from receptacle. Keep cords from heat, oil, and sharp edges.
13. Secure work. Use clamps or a vise to hold work. Using a vise or clamp is safer than using your hand, and both hands are free to operate the tool.
14. Do not over-reach. Keep proper footing and balance at all times.
15. Maintain tools with care. Keep tools sharp at all times, and keep them clean for the best and safest performance. Follow instructions for lubricating and changing accessories.
16. Disconnect tools when they are not in use, before servicing, and when changing attachments, blades, bits, cutters, etc.
17. Remove adjusting keys and wrenches. Form the habit of checking to see that keys and adjusting wrenches are removed from the tool before turning it on.
18. Avoid accidental starting. Do not carry a plugged-in tool with your finger on switch.

General Power Tools

Read and understand operator's manual.

1. Learn the power tool's applications and limitations as well as the specific potential hazards peculiar to the tool you are using.
2. Ground all tools unless double insulated. If the tool is equipped with a three-prong plug, it should be plugged into a three hole electrical receptacle. If an adapter is used to accommodate a two-hole receptacle, the grounding ear must be attached to a known ground. Never remove the third (grounding) prong.
3. Keep guards in place and in working order.
4. Keep work areas clean. Cluttered areas and benches invite accidents.
5. Avoid dangerous environments. Don't expose power tools to rain or use in damp or wet locations. Do not use tool in presence of flammable liquids or gases. Keep the work area well it.
6. Keep children away. All visitors should be kept a safe distance from the work area. Do not let visitor’s contact tool or extension cords.
7. Store idle tools.
8. Don't force tool. It will do the job better and safer at the rate for which it was designed.
9. Use right tool. Don't force a small tool or attachment to do the job of a heavy-duty tool. Don't use tool for a purpose it was not designed for, such as using a circular saw for cutting tree limbs or logs.
10. Wear proper apparel. No loose clothing or jewelry to get caught in moving parts. Rubber gloves and insulated non-skid footwear is recommended when working outdoors. Wear protective covering to contain long hair.
11. Use safety glasses at all times. Also, use a face or dust mask if cutting operation is dusty.
12. Don't abuse cord. Never carry the tool by its cord or yank it to disconnect from the receptacle. Keep cord from heat, oil and sharp edges.
13. Secure work. Use clamps or a vise to hold work. It's safer than using your hand and it frees both hands to operate tool.
14. Don't overreach. Keep proper footing and balance at all times.
15. Disconnect tools when not in use; before servicing; when changing accessories such as blades, bits, cutters, etc.
16. Guard against electric shock. Prevent body contact with grounded surfaces such as pipes, radiators, ranges, and refrigerator enclosures.
17. Remove adjusting keys and wrenches. Form a habit of checking to see that keys and adjusting wrenches are removed from tool before turning it on.
18. Maintain tools with care. Keep tools sharp and clean at all times for best and safest performance. Follow instructions for lubricating and changing accessories. Keep handles dry clean and free of oil or gas. Inspect switches, tool cords and extension cords periodically and have them repaired or replaced by an authorized service facility if damaged. Check moving parts for alignment and binding as well as for breakage and improper mounting.
19. Avoid accidental starting. Don't carry a plugged-in tool with your finger on the switch. Be sure the switch is turned off before plugging in a tool. Do not use a tool if the switch does not turn it on or off.
20. Wear ear protectors when using for extended periods.
21. Accessories -the use of any accessories other than what is listed or recommended for this particular tool may be hazardous.
22. Keep hands away from all moving parts, blades, bits, etc.

23. Use insulated surfaces. A double-insulated or grounded tool may be made live if the blade or bit comes in contact with live wiring in a wall, floor, ceiling, etc. Always check the work area for live wires and hold the tool by the insulated surfaces when "blind " sawing.
24. Stay alert. Watch what you are doing and use common sense. Do not operate tool when you are tired.
25. Grounding
    a. Double Insulated–tools with two prong plugs. Tools marked with the words "Double Insulated" are equipped with a two-prong plug.
    b. Grounded–tools with three prong plugs. These tools must be grounded while in use to protect the user from electric shock. The tool is equipped with an approved, three-conductor cord and three-prong grounding type plug to fit the proper grounding-type receptacle. The green conductor in the cord is the grounding wire. Never connect a green wire to a live terminal.

Power Tool Battery Safety

1. Replace batteries only with compatible batteries. See manufacturers' recommendations.
2. Do not charge or use battery in explosive atmospheres, such as in the presence of flammable liquids, gases or dust. Inserting or removing the battery from the charger may ignite the dust or fumes.
3. NEVER force battery pack into charger. DO NOT modify battery pack in any way to fit into a non-compatible charger as battery pack may rupture causing serious personal injury.
4. Charge the battery packs only in chargers provided with the power tool.
5. DO NOT splash or immerse in water or other liquids.
6. Do not store or use the tool and battery pack in locations where the temperature may reach or exceed 105 ˚F (40 ˚C) (such as outside sheds or metal buildings in summer).
7. Never attempt to open the battery pack for any reason. If battery pack case is cracked or damaged, do not insert into charger.
8. Do not crush, drop or damage battery pack. Do not use a battery pack or charger that has received a sharp blow, been dropped, run over or damaged in any way (i.e., pierced with a nail, hit with a hammer, stepped on). Damaged battery packs should be recycled.
9. WARNING: Fire hazard. Do not store or carry battery so that metal objects can contact exposed battery terminals. For example, do not place battery in aprons, pockets, tool boxes, product kit boxes, drawers, etc., with loose nails, screws, keys, etc. Transporting batteries can possibly cause fires if the battery terminals inadvertently come in contact with conductive materials such as keys, coins, hand tools and the like.

Specific safety instructions for Lithium Polymer and Li-ion batteries

1. Do not incinerate the battery pack even if it is severely damaged or is completely worn out. The battery pack can explode in a fire. Toxic fumes and materials are created when lithium ion battery packs are burned.
2. If battery contents come into contact with the skin, immediately wash area with mild soap and water. If battery liquid gets into the eye, rinse water over the open eye for 15 minutes or until irritation ceases. If medical attention is needed, the battery electrolyte is composed of a mixture of liquid organic carbonates and lithium salts.
3. Contents of opened battery cells may cause respiratory irritation. Provide fresh air. If symptoms persist, seek medical attention. See SDS for details.
4. WARNING: Burn hazard. Battery liquid may be flammable if exposed to spark or flame.

Disposing of batteries

1. Batteries that lose 20% of their capacity must be removed from service and disposed of properly as they contain toxic waste.
2. Discharge the battery.
3. Wrap the contacts with electrical (non-conductive) tape.
4. Dispose of the battery at an authorized recycling center (not a land fill).

Pipe Threading Machine

Read and understand operator's manual.

Warning: Clothing/gloves can be caught in moving parts; fingers, hands, arms or other body parts can be crushed or broken.

1. Use footswitch.
2. Do not wear gloves.
3. Keep sleeves and jacket buttoned.
4. Do not reach across machine because clothing can be drawn into moving parts.
5. Operate machine from switch side only.
6. Do not disconnect or block footswitch.
7. Keep footswitch in working order.
8. Make sure switch is in the "off" position before plugging in power cord.
9. Make sure you can quickly remove your foot from the footswitch.

Personal Safety:

1. Wear snug fitting clothes, safety shoes, hardhat and safety glasses. Cover up or tie up long hair. Do not wear loose clothing, gloves, unbuttoned jackets, loose sleeve cuffs, neckties, rings, watches or other jewelry.
2. Wear hearing protectors, earplugs or muffs if you use the machine daily or in a very noisy area.
3. Operate machine from the side with the REV/OFF/FOR switch.
4. Keep good footing and balance. Do not overreach.
5. Do not operate machine when you are tired.

Electrical Safety:

1. Ground machine. Use approved three-conductor cord and three-prong grounding type plug in a grounded receptacle. The green (or green and yellow) conductor in the cord is the grounding wire. Do not connect the green (or green and yellow) wire to a live terminal. If your unit is for use on less than 150 volts, it has a 120V plug. If it is for use on 150 to 250 volts, it has a 230V plug.
2. Connect machine to an AC power supply that matches the nameplate specifications. Do not use D.C. power.
3. Use only three-wire extension cords, which have three-prong grounding plugs and three-pole receptacles, which accept the machines plug. Replace or repair damaged, frayed, broken or worn cords.
4. When using an extension cord, be certain that the conductor size is large enough to prevent excessive voltage drop which will cause loss of power.
5. When using an extension cord outdoors, use cords marked with the suffix "W-A II following the cord type designation. For example, SJTW-A II indicates that the cord is acceptable for outdoor use.
6. Do not use machine in damp or wet locations. Do not expose to rain.
7. Unplug power cord when adjusting, servicing or changing accessories.

Work Area Safety:

1. Keep children and visitors out of work area. If visitors must be in an area keep them far away from the machine and extension cord.
2. Keep work areas clean, uncluttered and well lighted.
3. Keep floors dry and free of slippery materials.
4. Clear machine and bench of all objects such as wrenches or tools before turning machine on.

Machine Safety:

1. The machine is made to thread and cut pipe or bolts. Other uses may increase risk of injury.
2. Secure machine to bench or stand to keep it from tipping over.
3. Tighten chuck hand wheel and engage rear-centering device on the work before turning on machine.
4. Support long, heavy work from the floor with a pipe support to prevent tipping of machine.
5. Use recommended accessories. Use of other accessories may increase the risk of injury.
6. Check for broken or damaged parts before using machine. Repair or replace damaged guards or other machine parts by an authorized service center to insure proper operation of the machine.
7. Do not use machine if switches are broken.
8. Keep covers in place. Do not operate machine with covers removed.

Machine Maintenance:

1. Use sharp cutting tools.
2. Follow instructions for lubricating and changing accessories.
3. Inspect machine cord. Replace damaged, frayed, broken or worn machine cord.
4. Inspect extension cords. Repair or replace damaged, frayed, broken or worn cords.
5. Keep handles dry and clean. Keep free from oil and grease.
6. When not being used, store machine in a secured, locked area, out of reach of children and people unfamiliar with the threading machine.
7. Lock footswitch when not in use to avoid accidental starting.

Floor Jacks (Hydraulic)

1. Make sure that jack makes secure contact with the frame of equipment.
2. Be sure contact point is strong enough to not be damaged or unstable.
3. Always use jack stands to support equipment while performing repairs.
4. Put all equipment back in proper location.
5. Be sure to clean area of oil, grease and dirt.

Hand Tool Safety

1. Do not continue to work if your safety glasses become fogged. Stop work and clean the glasses until the lenses are clear and defogged.
2. Use tied off containers to keep tools from falling off of scaffolds and other elevated work platforms.
3. Carry all sharp tools in a sheath or holster.
4. Tag worn, damaged or defective tools "Out of Service" and do not use them.
5. Do not use a tool if its handle has splinters, burrs, cracks, splits or if the head of the tool is loose.
6. Do not use impact tools such as hammers, chisels, punches or steel stakes that have mushroomed heads.
7. When handing a tool to another person, direct sharp points and cutting edges away from yourself and the other person.
8. When using knives, shears or other cutting tools, cut in a direction away from your body.
9. Do not chop at heights above your head when you are working with a hand axe.
10. Do not carry sharp or pointed hand tools such as screwdrivers, scribes, aviation snips, scrapers, chisels or files in your pocket unless the tool or your pocket is sheathed.
11. Do not perform "make-shift" repairs to tools.
12. Do not use "cheaters" on load binders or "boomers".
13. Do not carry tools in your hand when you are climbing. Carry tools in tool belts or hoist the tools to the work area using a hand line.
14. Do not throw tools from one location to another, from one employee to another, from scaffolds or other elevated platforms.
15. Transport hand tools only in tool boxes or tool belts. Do not carry tools in your clothing.

Knives/Sharp instruments

1. When handling knife blades and other cutting tools, direct sharp points and edges away from you.
2. Cut in the direction away from your body when using knives.
3. Use the knife that has been sharpened; do not use knives that have dull blades.
4. Use knives for the operations for which they are named.
5. Do not use knives that have broken or loose handles.
6. Do not use knives as screwdrivers, pry bars, can openers or ice picks.
7. Do not leave knives in sinks full of water.
8. Do not pick up knives by their blades.
9. Carry knives with their tips pointed towards the floor.
10. Do not carry knives, scissors or other sharp tools in your pockets or an apron unless they are first placed in their sheath or holder.
11. Do not attempt to catch a falling knife.
12. Store knives in knife blocks or in sheaths after using them.
13. Follow this procedure for picking up any bags that have sharp objects protruding from them: Grab the top of the bag above the tie-off, using both hands, and hold the bag away from your body.
14. Do not submerge hot glass in cold water nor submerge cold glass in hot water.
15. When opening cartons use the safety box cutters. Do not cut with the blade extended beyond the guard.
16. Do not use honing steels that do not have disc guards.

Files/Rasps

1. Do not use a file as a pry bar, hammer, screwdriver or chisel.
2. When using a file or a rasp, grasp the handle in one hand and the toe of the file in the other.
3. Do not hammer on a file.

Chisels

1. Use the chisel that has been sharpened; do not use a chisel that has a dull cutting edge.
2. Do not use chisels that have "mushroomed" striking heads.
3. Hold a chisel by using a tool holder if possible.
4. Clamp small workpieces in the vise and chip towards the stationary jaw when you are working with a chisel.

Hammers

1. Use a claw hammer for pulling nails.
2. Do not strike nails or other objects with the "cheek" of the hammer.
3. Do not strike a hardened steel surface, such as a cold chisel, with a claw hammer.
4. Do not strike one hammer against another hammer.
5. Do not use a hammer if your hands are oily, greasy or wet.
6. Do not use a hammer as a wedge or a pry bar, or for pulling large spikes.
7. Use only the sledge type hammer on a striking face wrench.

Saws

1. Keep control of saws by releasing downward pressure at the end of the stroke.
2. Do not use an adjustable blade saw such as a hacksaw, coping saw, keyhole saw or bow saw, if the blade is not taut.
3. Do not use a saw that has dull saw blades.
4. Oil saw blades after each use of the saw.
5. Keep your hands and fingers away from the saw blade while you are using the saw.
6. Do not carry a saw by the blade.
7. When using the hand saw, hold the workpiece firmly against the work table.
8. Use the circular saw guard when using the circular saw.

Screwdrivers

1. Always match the size and type of screwdriver blade to fit the head of the screw.
2. Do not hold the workpiece against your body while using a screwdriver.
3. Do not put your fingers near the blade of the screwdriver when tightening a screw.
4. Use a drill, nail, or an awl to make a starting hole for screws.
5. Do not force a screwdriver by using a hammer or pliers on it.
6. Do not use a screwdriver as a punch, chisel, pry bar or nail puller.
7. When you are performing electrical work, use the screwdriver that has the blue handle; this screwdriver is insulated.
8. Do not carry a screwdriver in your pocket.
9. Do not use a screwdriver if your hands are wet, oily or greasy.
10. Do not use a screwdriver to test the charge of a battery.
11. When using the spiral ratchet screwdriver, push down firmly and slowly.

Wrenches

1. Do not use wrenches that are bent, cracked or badly chipped or that have loose or broken handles.
2. Do not slip a pipe over a single head wrench handle for increased leverage.
3. Do not use a shim to make a wrench fit.
4. Use a split box wrench on flare nuts.
5. Do not use a wrench that has broken or battered points.
6. Use a hammer on striking face wrenches.
7. Discard any wrench that has spread, nicked or battered jaws or if the handle is bent.
8. Use box or socket wrenches on hexagon nuts and bolts as a first choice, and open end wrenches as a second choice.

Pliers

1. Do not use pliers as a wrench or a hammer.
2. Do not attempt to force pliers by using a hammer on them.
3. Do not slip a pipe over the handles of pliers to increase leverage.
4. When you are performing electrical work, use the pliers that have the blue rubber sleeves covering the handle; these pliers are insulated.
5. Do not use pliers that are cracked, broken or sprung.
6. When using the diagonal cutting pliers, shield the loose pieces of cut material from flying into the air by using a cloth or your gloved hand.

Vises & Clamps

1. When clamping a long workpiece in a vise, support the far end of the workpiece by using an adjustable pipe stand, saw horse or box.
2. Position the workpiece in the vise so that the entire face of the jaw supports the workpiece.
3. Do not use a vise that has worn or broken jaw inserts, or has cracks or fractures in the body of the vise.
4. Do not slip a pipe over the handle of a vise to gain extra leverage.
5. Do not use the C-clamp for hoisting materials.
6. Do not use the C-clamp as a permanent fastening device.

Snips

1. Wear your safety glasses or safety goggles when using snips to cut materials.
2. Wear your work gloves when cutting materials with snips.
3. Do not use straight cut snips to cut curves.
4. Keep the blade aligned by tightening the nut and bolt on the snips.
5. Do not use snips as a hammer, screwdriver or pry bar.
6. Use the locking clip on the snips after you have finished using them.

Tool Boxes/Chests/Cabinets

1. Use the handle when opening and closing a drawer or door of a tool box, chest, or cabinet.
2. Tape over or file off sharp edges on tool boxes, chests or cabinets.
3. Do not stand on tool boxes, chests or cabinets to gain extra height.
4. Lock the wheels on large tool boxes, chests or cabinets to prevent them from rolling.
5. Push large chests, cabinets and tool boxes; do not pull them.
6. Do not open more than one drawer of a tool box at a time.

7. Close and lock all drawers and doors before moving the tool chest to a new location.
8. Do not use a tool box or chest as a workbench.
9. Do not move a tool box, chest or cabinet if it has loose tools or parts on the top.

Bench Vise

1. Mount the vise firmly. Keep it tight on bench. A loose vise is dangerous and inefficient.
2. Lock swivel base securely. Tapered-gear lock bolt prevents slippage.
3. Do not hammer the handle. Too much pressure may damage the work.
4. Never use handle extension. Normal leverage will hold work securely in place.
5. Do not hammer the beam. Your vise will give almost unlimited use. But it will not stand continued abuse.
6. Oil the screw. Remove front jaw. Use oil or light grease. This should be done frequently to prevent screw wear.
7. Keep jaw faces clean. Use wire brush or file card to remove chips and dust.

Bench Grinder

1. Operate only after you have received instruction.
2. Wear proper clothing.
3. Wear face shield, safety glasses, or goggles and use glass safety guard on grinder.
4. See that the guard is in place.
5. Set tool rest 1/16 inch to 1/8 inch from the wheel.
6. Dress wheel when necessary.
7. Make sure that no one but you is inside the operator's area.
8. Adjust grinder for your job before turning power on
9. Stand to one side of wheel when turning power on. The wheel may be cracked, causing it to break up.
10. Turn on power after permission is given.
11. Keep hands away from the wheel while it is in motion.
12. Hold work with your hands. Ask permission to grind small pieces.
13. Use the face of the wheel only.
14. Press materials against wheel with correct amount of pressure.

Horizontal Band Saw

1. Operate only after you have received instruction.
2. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Make sure all guards are in place and operating correctly.
4. Always use proper eye protection.
5. All adjustments to the chip-removal brushes, blade tension, guides, vise, or drive system should be done with the power off.
6. Be sure blade guides are properly adjusted to both the blade and the work size or vise before starting cut.
7. Adjust feed rate so blade does not bounce or plunge into work when starting the cut.
8. Be sure work is tightly clamped in the vise and properly positioned for an efficient, safe cut.
9. Keep hands away from cutting area and brush away chips only when the machine is turned off.
10. If the material requires coolant, be sure that the system is working and that the correct coolant is used.

Portable Air Impact Wrench

1. Operate only after you have received instruction.
2. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Always use proper eye protection.
4. Be sure throttle is in the "off" position before connecting to air supply.
5. Always use impact-type sockets designed for use with power equipment.
6. Make sure work is secure or held with clamps or tightly in a vise.
7. Set torque control for correct tightness before starting the job.
8. Be sure both hands are free to properly operate an impact tool.
9. Maintain balance and firm footing at all times.
10. Always use the tool in short bursts of power.
11. Quick-change coupling should be at end of hose whip, not at the tool
12. Always disconnect the tool when not in actual use.

Portable Disc Sander/Grinder

1. Operate only after you have received instruction.
2. Wear proper clothing. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Make sure all guards are in place and operating properly.
4. Wear a face shield and safety glasses. Use hearing protection.
5. Inspect the cord for damage. Repair or replace damaged cords before use.
6. Don't abuse cord. Never carry the tool by its cord or yank it to disconnect from the receptacle. Keep cord from heat, oil and sharp edges.
7. Before connecting to the power source, be sure the switch is in the "off" position.
8. Make sure back-up pad and disc are securely fastened to the tool. Unplug the sander when changing discs.
9. Do not allow the edge of the disc to touch the edge of the stock.
10. Stand clear of the spark line or spark area. Sparks are hot.
11. Sand or finish with a stroking motion; do not pause in one spot.
12. Allow the tool to stop before sitting down the tool. Set sander on back or on rubber stand when not in use and disconnect from power source.

Portable Electric Drill

1. Operate only after you have received instruction.
2. Wear proper clothing. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Always use proper eye protection.
4. Inspect the cord for damage. Repair or replace damaged cords before use.
5. Don't abuse cord. Never carry the tool by its cord or yank it to disconnect from the receptacle. Keep cord from heat, oil and sharp edges.
6. "Unplug" the drill when changing bits.
7. Make sure switch is off and chuck key removed before connecting to power source.
8. Mark hole location with center punch (metal) or AWL (wood) before drilling.
9. Be sure work is tightly clamped or otherwise secure before drilling.
10. Drill with straight, even, steady pressure.

Oxygen-Acetylene Welder

1. Operate only after you have received instruction.
2. Wear proper clothing and protective equipment. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Be sure that you wear welding goggles. All assistants and observers must also wear welding goggles.
4. Close cylinder valve and replace protective cover before moving cylinder.
5. Fasten cylinders with a chain or other suitable device as a protection against falling or rolling.
6. Keep welding equipment free of oil and grease. Use only clean rags for wiping off welding equipment.
7. Inspect hose before using.
8. Make sure that hose is properly connected and that all connections are tight.
9. Report any leaking of cylinders or connections to supervisor immediately.
10. Make sure you have ample ventilation.
11. Keep all flammable material away from working area.
12. Release regulator pressure screw. Open cylinder valves gradually.
13. Open acetylene cylinder valve 1 turn or less. Keep wrench in place so that valve may be shut off quickly if necessary.
14. Keep acetylene pressure in the hose below 15 pounds per square inch
15. Use a flint lighter to ignite torch.
16. Close acetylene valve first if torch backfires.
17. Make certain lighted torch always points away from you and other students.
18. Keep sparks and flame away from cylinders.
19. Close cylinder valve when you have finished your welding job.
20. Quench section of metal that has been welded or mark with chalk or soapstone the word "hot" on the metal if it is necessary for you to leave your work.

Electric Welder

1. Operate only after you have received instruction.
2. Wear proper clothing to protect from arc burns. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Wear a hood with proper observation window, treated gauntlet gloves, and treated leather apron. All assistants and observers must also wear this equipment.
4. Rubber-soled shoes, without tacks, should be worn when electric welding.
5. Operator of electric welder is to allow no one to look at the arc without the dark shield (No. 10-12 lens).
6. Make sure electric welding is done only in a correctly constructed booth or room, or behind proper screens.
7. Make sure there is ample ventilation.
8. Keep all flammable material away from working area.
9. See that floor area is clear of all obstructions.
10. Report to supervisor at once if electrode holder, holder cable connection, cable, or cable terminals at the welding machine, ground clamps, lugs, or cable get hot.
11. While removing scale from the work, wear ordinary safety glasses or goggles.
12. Have a dry-chemical fire extinguisher handy when electric welding.
13. Hang up electrode holder and turn off welder when work is being changed or when work has been completed.

GMAW (MIG) and GTAW (TIG) Welder

1. Operate only after you have received instruction.
2. Wear proper clothing to protect from arc burns. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Make sure all guards are in place and operating correctly.
4. Always use proper eye protection.
5. Always buff using the lower half of the buffing wheel.
6. Additional protective welding clothing, including a helmet, long-sleeve jacket, and gloves, must be worn to prevent burns from ultraviolet and infrared rays emitted while arc welding.
7. The helmet used for GTAW welding should be equipped with a minimum number-12 density shade.
8. Be certain that the welder equipped with a high-frequency stabilizing unit is installed, maintained, and used according to the recommendations of both the manufacturer and Federal Communication Commission.
9. Never touch the tungsten electrode or wire electrode while the welder is turned on. It is electrically "hot" and can cause a serious shock.
10. Never use the high frequency when performing shield metal arc (stick electrode) welding.

Spot Welder

1. Always wear a protective face shield in addition to proper eye protection.
2. Do not weld with wet hands or in a damp area.
3. Do not touch the tips, tongs, or welded material after welding as they become very hot.
4. Never leave the spot welder unattended with the electrical cord plugged in.
5. The metal being spot-welded must be clean and dry.
6. When spot welding galvanized material, remove the galvanize from the area being welded. Avoid the fumes.
7. Check and adjust the timer for the correct duration before starting the welder.

Plasma Cutter[19]

Read and understand operator's manual.

1. To activate the plasma arc cutter make sure the air pressure is around 70 p.s.i. for most plasma arc cutter units and the ground clamp is attached to the work piece.
2. Turn the plasma arc cutter on and adjust the amperage the manufacturer's specifications for the thickness of metal to be cut.
3. Position the shielding cup over the metal, press the igniter button and allow the arc to become established. Next, move the arc over the cut line and make the cut.
4. The thicker the metal the slower the travel speed must be to get a good cut and vice versa. The quality of the cut usually decreases as the metal thickness increases and the travel speed decreases.
5. A guide bar may be used to help achieve good straight cuts.
6. The shielding cup and constricting nozzle should be held approximately 1/8" to 1/4" above the metal being cut. The operator should avoid dragging the constricting nozzle and shielding cup on the metal when making the cut unless they are specifically designed to touch the base metal while cutting.
7. Always make cuts on the waste side of the cut line.
8. Avoid cutting with the plasma arc cutter in damp or wet locations. The hazards of electrical stock greatly increased.
9. If plasma arc cutting over an open barrel with a grate be aware that the fume plume will be directed back toward the operator. Avoid this condition if at all possible, otherwise limit the exposure to fumes to short duration's.
10. Cuts with the plasma arc cutter may be made by moving forward, backward, or sideways. Determine which direction is easiest for you and use that procedure as often as possible.
11. Always move the plasma arc cutter (PAC) as fast as possible when making a cut. This increases time efficiency, improves the cut quality, and reduces the buildup of dross.
12. Compressed air used in plasma arc cutter should be dry or the cutter will not yield a quality cut or it not cut at all. An auxiliary air filter may be place in the compressed air line to condition the air for a plasma arc cutter.
13. Always turn the plasma arc cutter off before laying the torch down and leaving the work area.
14. If the quality of the cut deteriorates to an unacceptable level the constricting nozzle, the electrode, or both may need to be changed. The electrode on most plasma arc cutter will have a life of about twice the life of the constriction nozzle. Keep a supply of constricting nozzles and electrodes on hand as they deteriorate quickly during continuous use. Turn the plasma arc cutter off to put on replacement parts.
15. Keep the plasma arc cutter torch leads and ground lead stored so they will not be cut or damaged when not in use.

Plasma Arc Cutter Safety:

1. Wear protective clothing when using the plasma arc cutter. Clothing should be wool or cotton, long sleeves, leather shoes (High Top), gauntlet gloves and leather apron.

[19] Adapted from Virginia Tech Department of Agricultural, Leadership, and Community Education.. Available at http://www.alce.vt.edu/teacher-resources/lab-safety-resources/plasmsaarcutter.pdf

2. Never wear synthetic clothing when using the plasma arc cutter, many synthetics are highly flammable.
3. Always wear industrial quality eye protection a #5 shaded lens is the minimum for the plasma arc cutter process. The shaded lens needed to adequately protect he eyes varies by the thickness of the metal being cut and the intensity of the arc required to make the cut. Follow the manufacturer's recommendation for selecting an appropriate shaded lens for given plasma arc cut.
4. Make sure that work area is well ventilated when using the plasma arc cutter. The plasma arc cutter process generates lots of fumes and therefore must be well ventilated.
5. The operator should position himself/herself so there will be minimum exposure o fumes during the cutting process.
6. Fumes from the following metals can be toxic and in some cases fatal.

Antimony	Arsenic	Beryllium
Barium	Cadmium	Chromium
Cobalt	Copper	Lead
Manganese	Mercury	Nickel
Selenium	Silver	Vanadium

7. Use a cutting table which has a down draft to capture fumes. A cutting table with water filtration is also recommended for plasma arc cutting.
8. Never use the plasma arc cutter in areas where combustible or explosive gases or materials are located.
9. Chlorinated solvents and cleaner vapors in the presence of plasma arc cutter generates a toxic phosgene gas. Avoid plasma arc cutting use in areas which house chlorinated solvents and cleaners.
10. Never touch any parts on the plasma arc cutter that are electrically connected. The plasma arc cutter uses high amperage and produces high voltage which can cause severe or fatal electrical shock.
11. Disconnect the electrical power before performing any service or repair on the plasma arc cutter.
12. Do not use the plasma arc cutter to cut on containers that have held combustible materials.
13. Hydrogen gas may be formed and trapped when cutting aluminum in the presence of water. Trapped hydrogen gas in the presence of an are will ignite and explode, make sure fumes are well ventilated when cutting aluminum.
14. Hearing protection should be worn when operating the plasma arc cutter.
15. Make sure that others in the work area are protected from the plasma arc cutter arc rays and fumes.
16. Use pliers or tongs to handle hot metals cut by the plasma arc cutter. Cool and store hot metal before leaving the work area.

Metal Cutoff Saw Safety

1. Operate only after you have received instruction.
2. Wear proper clothing. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Make sure the stock is tightly clamped in place before starting your cut. If it isn't, the blade will grab it and roll it around.
4. Keep your hands clear of the path of the blade at all times. Some of these saws cut automatically; on others, you control the cut. In either case, keep your hands clear and out of danger.
5. Do not force the cut. There is often a temptation to speed things up by pushing on the saw but this could overload the machine or damage the blade.
6. Although these saws cut automatically, you should always watch the cut as it proceeds. The blade could twist or jam, the stock could twist free, or the saw could fail to stop when it should. Be there.
7. Take care in handling fresh cut pieces of metal; they could be sharp and hot. Cool and deburr them right away.
8. If metal chips or filings build up in the saw, turn it off and clean it with a brush. Never use your hand. Metal slivers really hurt.
9. Wear eye and hearing protection.
10. Wear appropriate gloves when handling the stock.

General Safety Instructions for Operating Power Woodworking Machines and Tools

Check to insure that:

1. Wear proper clothing. Remove jewelry, eliminate loose clothing, and confine long hair.
2. Goggles, glasses, or face shields are worn at all power machines.
3. Long hair is controlled by hairnet or appropriate cap.
4. The tool rest of the grinder is set properly.
5. Tool rests on lathes which are in operation are secured.
6. Tools and scraps are not left on the floor.
7. Oily rags are placed in a metal safety can.
8. Oil spots are wiped from the floor.
9. No tools with mushroomed heads or loose or broken handles are used.
10. All files have handles before students use them.
11. All accidents are reported to the supervisor and taken care of properly.
12. No “horseplay” of any kind occurs in the shop.
13. The tool room has no defective tools in the rack.
14. No safety guards are removed from machinery.
15. No operator walks away from his/her machine and leaves it running.
16. All danger zones are marked.
17. No one talks to or touches anyone operating a machine.
18. Shirt tails are to be tucked in at ALL times.
19. Coats or sweaters are not worn while students are working.

Table Saw

1. Operate only after you have received instruction.
2. Wear proper clothing. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Wear safety goggles or glasses.
4. Make sure saw guards are in place and operative. Guards must be kept down over the saw while machine is being operated.
5. The saw must not be raised above the table *more* than absolutely necessary to make the cut, approximately 1/8 inch.
6. A push stick must be used when ripping narrow pieces of lumber.
7. The clearance block must be fastened to fence when cutting off short pieces of stock.
8. Fence must not be adjusted until saw is at a dead stop.
9. Sawdust underfoot is slippery; keep floor around saw area clean.
10. Use brush to keep table clear of scraps; never use the hands.
11. Fingers must be kept clear of track of saw, and hands must never be allowed to cross saw line in advance of the end of the board while machine is in operation.
12. Reaching over the saw blade or passing wood over saw blade is prohibited.
13. All special set-ups and dado heads must be inspected by supervisor before power is turned on.
14. The dado head must be taken off the saw arbor after use.
15. When helping to "tail-off" the saw, students must never pull on a board being ripped. They should hold board up and allow operator to push stock through saw.
16. Re-sawing must not be done on circular saw without special permission of the supervisor.
17. Cylindrical stock must not be cut on circular saw.
18. Never lower pieces of stock down over the saw. This operation is sometimes performed when cutting holes in rails for drawer fronts. Special permission should be obtained from the supervisor for doing this type of work.
19. Ripping stock without using the ripping fence or cross-cutting stock without using the sliding cross-cutting fence is extremely dangerous and is absolutely forbidden. This rule applies to dado head work.
20. See that no fence or set-up will be in line of saw before starting work or turning on power.
21. Be sure that saw or tilting arbor saw will clear on both sides when sawing angles before power is turned on.
22. Never stand directly behind the blade; stay to the left.
23. Only operator turns machine on and off.
24. Only operator should be in safety area of the saw.

Band Saw

1. Operate only after you have received instruction.
2. Wear proper clothing. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Wear safety goggles or glasses.
4. Always keep guards in place. Both upper and lower wheels, as well as most of the blade itself, shall be guarded.
5. Adjust the guard to about 1/4 inch above thickness of stock.
6. The upper and lower guides shall be properly adjusted when machine is stopped completely, so that there will be a minimum of blade breakage.
7. A clicking or cracked blade should be stopped immediately.
8. The saw shall be allowed to stop itself naturally in order that the blade may not be damaged.
9. Plan your cuts carefully; layout and make release cuts before cutting long curves.
10. If the stock binds or pinches the blade, do not attempt to back out until power has been shut off and the machine stops.
11. Proper blade width for the diameter of work being cut shall be used. Avoid cutting a radius to small for the blade width and pinching the blade.

Blade Width	1/8"	3/16"	1/4"	3/8"	1/2"	3/4"	1"
Cut Radius	3/16"	5/16"	5/8"	1 1/2"	2 1/2"	5 1/2"	7"

12. The right side of the machine is generally the most dangerous place to stand in case of blade breakage.
13. Proper blade tension shall be maintained.
14. The blade shall be sharp and properly set at all times.
15. Remove scrap material from saw table with a stick or brush.
16. If the blade breaks, shut off power and stand clear until machine stops entirely.
17. Make cuts always under power--never while machine is coasting.
18. Leave the machine only after power is turned off and blade has stopped moving. This is especially important with the band saw.

Jig/Scroll Saw

1. Operate only after you have received instruction.
2. Wear proper clothing. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Wear face shield, safety glasses, or goggles.
4. Cut only stock with a flat surface on bottom.
5. Make adjustments only when machine is at a dead stop.
6. Install saw blades to cut on the downstroke.
7. Tighten blade securely in lower vise, then in upper vise. Check blade for correct tension.
8. Make sure the saw blade is the proper size for the job.
9. Adjust hold-down so it will be as close as possible to the work.
10. Turn machine by hand to make sure all parts are clear.
11. Make sure that no one but you is inside the operator's line.
12. Select correct machine speed for the material and blade type.
13. Lower the ho1d-down foot to press lightly on the surface of the wood.
14. Turn on power after permission is given.
15. Hold material firmly.
16. Feed the material into the machine at a moderate rate of speed.
17. Keep fingers away from saw and hands out of the path of saw.
18. Report mechanical defects or a broken blade to the supervisor.
19. Turn off power after using scroll saw and stand by until the machine has stopped.
20. Clear away scraps of wood on the table only after saw stops running.

Radial Arm Saw

1. Operate only after you have received instruction.
2. Wear proper clothing while operating machine. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Wear safety goggles or glasses.
4. Always keep guards in place.
5. Before starting the machine, all clamping devices should be tight.
6. Saw must be kept well sharpened.
7. Be sure saw swings clear and free.
8. Place stock snugly against backstop, and flat on the table.
9. Operate the saw with your left hand, never reach across your body to operate the saw.
10. Set the anti-kickback device 1/8 inch above the material to be cut.
11. While ripping, the rip lock should be tight.
12. Two people are necessary while ripping.
13. While ripping, be sure to feed the material from the infeed end of the saw guard, never from the kickback end. Make no exception to this rule.
14. Before making special adjustment, the saw must be fully stopped.
15. Before starting the motor, make sure everything is clear of the cutter.
16. Remove scraps from the path of the radial-saw blade with a piece of wood while the saw is at a dead stop.
17. Stand to one side and keep your hands away from the direction of travel of the radial-saw blade.
18. A radial arm saw is used primarily for crosscutting stock. Use a table saw for ripping when possible.

Drill Press

1. Eye protection must be worn at all times.
2. Restrain loose clothing and hair. Remove hand jewelry.
3. Select an appropriate speed for bit and material (see chart below) - fast for small holes, slow for large ones. Too slow is better than too fast. Be sure to replace guards if removed for a speed change.
4. Tighten the bit and remove the chuck key.
5. Clamp the material to the table where possible. All small work must be secured. Be very cautious when drilling thin stock like sheet metal.
6. Use cutting oil when drilling metal.
7. If the material becomes caught by the bit. Step back and turn off the machine. Do not reach for the stock if spinning with the drill.

Approximate Speeds for High Speed Steel Drills**						
			Drill Diameter			
Materials	SFM* Range		1/4"	1/2"	1"	1 1/2"
Aluminum and its Alloys	200	300	3820	1910	955	637
Brass and Bronze (Ordinary)	150	300	2292	1146	573	382
Bronze (High Tensile)	70	150	1070	535	267	178
Die Castings (Zinc Base)	300	400	4584	2292	1146	764
Iron-Cast (Soft)	100	150	1528	764	382	255
Cast (Medium hard)	70	100	1070	535	267	178
Hard Chilled	30	40	458	229	115	76
Malleable	80	90	1222	611	306	204
Magnesium and its Alloys	250	400	3820	1910	955	637
Monel Metal or High-Nickel Steel	30	50	458	229	115	76
Plastics or Similar Materials (Bakelite)	100	300	1528	764	382	255
Steel - Mild (.2 carbon to .3 carbon)	80	110	1222	611	306	204
Steel (.4 carbon to .5 carbon)	70	80	1070	535	267	178
Tool (1.2 carbon)	50	60	764	382	191	127
Forgings	40	50	611	306	153	102
Alloy - 300 to 400 Brinell	20	30	306	153	76	51
High Tensile (Heat Treated)						
35 to 40 Rockwell C	30	40	458	229	115	76
40 to 45 Rockwell C	25	35	382	191	96	64
45 to 50 Rockwell C	15	25	229	115	57	38
50 to 55 Rockwell C	7	15	107	53	27	18
Stainless Steel						
Free Machining Grades	30	80	458	229	115	76
Work Hardening Grades	15	50	229	115	57	38
Wood (soft)	300	400	4584	2292	1146	764

*SFM=Surface Feet per Minute

**Based on RPM=SFM*3.82/diameter

Planer/Surfacer

1. Operate only after you have received instruction.
2. Wear proper clothing while operating machine. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Wear safety glasses or goggles.
4. Make sure guards are in place and operative.
5. Do not plane two or more pieces of stock with various thicknesses. It could be kicked out. Plane only one thickness at a time. (Note: Some planers have sectional feed rollers, which could allow planing various thicknesses. Supervisors make appropriate decision.)
6. Keep your fingers from under the stock as it is fed through the planer.
7. Stock must be at least 15 inches long or greater than the distance between centers of infeed and outfeed rollers. True one face of the stock on the jointer before planing,
8. Always make sure machine is turned off before leaving.
9. Make sure no one is behind machine while in operation.
10. Always stand erect and to one side of work being planed.
11. Do not look into the planer as board passes through.
12. Plane no thickness less than 3/8 inch.
13. Stock that is 8 inches in width or less should not be planed more than 1/16” per cut.
14. Stop the planer and run all pieces through, reducing all to the same thickness.
15. With a rule, measure the thickness of the stock at the thickest point.
16. Place the stock on the bed of the planer with the working face down and the grain turned so that the knives will cut with the grain. Hold the board flat on the feed-in table when starting the cut. The knives on a single-surface planer cut on the upper side and revolve in a direction opposite to the direction of feed.
17. Never attempt to plane cross-grain.

Jointer

1. Operate only after you have received instruction.
2. Wear proper clothing while operating machine. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Wear safety glasses or goggles.
4. Make sure guard is in place and operating freely.
5. Always check the depth of cut before starting the machine.
6. Plane no thickness greater than 1/4 inch.
7. Keep your fingers well away from the cutterhead and never placed on the stock above the cutterhead.
8. Stock must be at least 18 inches long.
9. Always use a push stick to push the end of the stock across the cutterhead.
10. Always make sure machine is turned off before leaving.
11. Make sure everyone is from behind machine while in operation.
12. Always stand erect and to one side of work being planed.
13. Never attempt to plane cross-grain.

Wood Lathe[20]

1. Operate only with instructor's permission and after you have received instruction.
2. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Make sure all guards are in place and operating correctly.
4. Always use proper eye protection.
5. The tool rest must be close to the work when cutting tools are being used.
6. The cutting tools must be kept sharp.
7. Do not feel for smoothness of work while machine is running.
8. Work must be centered, balanced, and secured.
9. The tool rest must be removed while sanding.
10. Examine set up and turn work by hand before turning on power.
11. Shut off power while cleaning machine.

Power Miter Saw

1. Operate only after you have received instruction.
2. Wear proper clothing while operating machine. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Wear face shield, goggles, or safety glasses.
4. Make sure all guards are in place and are operating properly.
5. Be sure power is disconnected before making angle adjustments or changing blades.
6. Always hold the work firmly against the fence and table.
7. Never reach across your body to operate the saw.
8. Allow motor to reach full speed before starting to cut.
9. Apply smooth steady pressure to the motor when cutting.
10. Lock the slide (if equipped) when not in use. When using the slide, start your cur at the front of the work and push the saw into the work.
11. Use the brake to stop the blade before removing scrap or chips from the work area.

[20] Adapted from: Safety Guide for Career and Technical Education. Career and Technical Education, Washington Office of Superintendent of Public Instruction. 2002.

Portable Jig Saw

1. Operate only after you have received instruction.
2. Wear proper clothing while operating machine. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Always use proper eye protection.
4. Inspect the cord for damage. Repair or replace damaged cords before use.
5. Don't abuse cord. Never carry the tool by its cord or yank it to disconnect from the receptacle. Keep cord from heat, oil and sharp edges.
6. Make sure all guards are in place and are operating correctly,
7. Make sure the blade is the correct type for the material and that it is tightly clamped in the chuck.
8. Be sure the switch is off before connecting to the power source.
9. Use vise or clamps to securely hold material to be cut.
10. Keep cutting pressure constant; do not force the blade into the work.
11. Always keep the base tightly against the materials being cut.
12. Do not set the saw down on the bench until it has stopped.
13. If the blade is in the tool, be sure and lay the tool on its side.

Circular Saw

1. Operate only after you have received instruction.
2. Wear proper clothing. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Make sure all guards are in place and operating properly.
4. Wear face shield, goggles, or safety glasses.
5. Inspect the cord for damage. Repair or replace damaged cords before use.
6. Don't abuse cord. Never carry the tool by its cord or yank it to disconnect from the receptacle. Keep cord from heat, oil and sharp edges.
7. Make sure the telescoping guard returns automatically to cover the blade after each cut. Test before operation.
8. Check the base setting for the proper depth of cut.
9. Make sure the power cord is clear of the blade.
10. Make sure your hands are away from the blade before starting. Do not support material with your leg or foot.
11. Be sure the material you are cutting is adequately supported.
12. Start saw away from the work. Do not start the cut until the blade has reached full speed.
13. Advance the saw slowly, straight through the work. Do not twist or turn.
14. If the saw blade binds or smokes, stop cutting immediately.
15. The blade should be extended below the work until the blade gullets clear the material.
16. Do not set the saw down until the blade stops.

Using a Woodworker's Vise

1. Keep the vise tight on the bench. A loose vise is inefficient.
2. Keep your work clean. Never oil or grease a woodworker's vise.
3. Do not over-tighten.
4. Normal handle leverage holds jaws securely. Do not hammer the handle. Never pound to tighten or loosen. Do not use handle extension.
5. Avoid using woodworker's vise to clamp glue joints. Dried glue on vise screw, etc., makes vise operation difficult.
6. Do not use the vice to hold metal objects.

Router[21]

Read and understand operator's manual.

1. Wear safety glasses or goggles, or a face shield (with safety glasses or goggles) and appropriate hearing protection.
2. Disconnect the power supply before making any adjustments or changing bits. Inspect bits carefully before installing
3. Inspect the cord for damage. Repair or replace damaged cords before use.
4. Don't abuse cord. Never carry the tool by its cord or yank it to disconnect from the receptacle. Keep cord from heat, oil and sharp edges.
5. Ensure that the bit is securely mounted in the chuck and the base is tight.
6. Put the base of the router on the work, template or guide. Make sure that the bit can rotate freely before switching on the motor.
7. Secure stock that you are working on. Never rely on yourself or a second person to support or hold the material. Sudden torque or kickback from the router can cause damage and injury.
8. Before using a router, check stock thoroughly for staples, nails, screws or other foreign objects.
9. Keep all cords clear of cutting area.
10. Hold both hands on router handles always, until a motor has stopped. Do not set the router down until exposed router bit has stopped turning.
11. Do not overreach. Keep proper footing and balance.
12. When inside routing, start the motor with the bit above the stock. When the router reaches full power, lower bit to required depth.
13. When routing outside edges, guide the router counter clockwise around the work.
14. When routing bevels, moldings and other edge work, make sure the router bit is in contact with the stock to the left of a starting point and is pointed in the correct cutting direction.
15. Feed the router bit into the material at a firm, controlled speed.
16. With softwood, you can sometimes move the router as fast as it can go.
17. With hardwood, knotty and twisted wood, or with larger bits, cutting may be very slow.
18. The sound of the motor can indicate safe cutting speeds. When the router is fed into the material too slowly, the motor makes a high-pitched whine. When the router is pushed too hard, the motor makes a low growling noise.
19. When the type of wood or size of the bit requires going slow, make two or more passes to prevent the router from burning out or kicking back.
20. To decide the depth of cut and how many passes to make, test the router on scrap lumber similar to the work.

[21] Adapted from Canadian Centre for Occupational Health & Safety. Available at https://www.ccohs.ca/oshanswers/safety_haz/power_tools/router.html

Palm Sander

1. Do not sand paints that contain lead.
2. Use safety glasses and a dust mask to avoid breathing any dust.
3. SECURE any loose fitting jewelry or clothing, tie back long hair - they can get caught in moving parts
4. Disconnect the plug from the power source before making any adjustments, changing accessories, or storing the sander
5. DO NOT wet sand with the sander. Liquids may enter the motor housing and cause electric shock
6. DO NOT USE sand paper that is torn. Damage to the rubber backing pad may occur

Belt Sander

1. Do not sand paints that contain lead.
2. Use safety glasses and a dust mask to avoid breathing any dust.
3. SECURE any loose fitting jewelry or clothing, tie back long hair - they can get caught in moving parts
4. Inspect the cord for damage. Repair or replace damaged cords before use.
5. Don't abuse cord. Never carry the tool by its cord or yank it to disconnect from the receptacle. Keep cord from heat, oil and sharp edges.
6. Disconnect the plug from the power source before making any adjustments, changing accessories, or storing the sander
7. Be sure that sander is turned off before starting. State the sander only when over the work.
8. Hold securely when starting as the sander will pull away from the operator.
9. Keep cord clear of the sander.
10. When operating check that belt remains centered and tracking smoothly on the rollers. Adjust as necessary.
11. Always keep the sanders moving back and forth over the work.
12. Be sure the sander is at a complete stop before setting on the workbench.

Pneumatic Nail Gun[22]

Read and understand operator's manual.

1. Always wear safety glasses.
2. Do not touch the trigger unless firing the tool against a work piece.
3. Use extreme caution when using an air tool around other students.
4. Never point the tool at anyone. Treat the tool like a firearm and assume it's loaded.
5. Never load the gun while it is connected to a compressor.
6. Disconnect the air hose before clearing a jam or making adjustments.
7. Use manufacturer's specified pressures for the tool.
8. Keep your free hand safely out of the way of the tool.
9. Always know what type of trigger mode the nail gun is equipped with.
10. Secure the hose when working on scaffolding to prevent the weight of the hose from dragging the tool off the scaffold if you set the tool down.

Cautions:

Ricochet accidents can occur if you nail into another nail, the surface is too hard, or the tool is at an angle. Work with a nail gun only from a sturdy and stable surface. Do not press your finger on the trigger unless you're ready to fire, especially when climbing ladders.

Trigger selection Sequential mode and Bump mode are the two basic trigger mechanisms used in pneumatic nailers and staplers. It is important to understand the differences between the two triggers in order to prevent injuries.

Sequential Mode Trigger

In the sequential mode, also known as a restrictive trigger or operating in the trigger fire mode, you must first press the nail gun firmly against the workpiece and then press the trigger. One nail is fired and you must release the trigger before you can begin the next nailing cycle.

Bump Mode Trigger

In the bump mode trigger, also known as dual action, bottom fire, or contact trip, you must press the trigger before you bring the nail gun into contact with the workpiece. Each time you press the nailer against the workpiece, a nail is fired and a nailing cycle begins. You must keep the trigger pulled while moving the tool along the work surface with a bouncing motion, depressing the safety element where you want to drive a nail or staple. By repeatedly "bumping" the nail gun against the workpiece, you can rapidly fire any number of nails.

To find out whether your nail gun is a sequential trigger or bump trigger model:

1. Fire a nail as usual and keep the trigger depressed.
2. Lift the nail gun and carefully press its nose against the work surface again. If the gun fires a second nail, you have a bump trigger model.
3. If the gun doesn't fire, you have the sequential trigger model.

[22] Oregon OSHA Standard and Technical Resources. Available at http://www.cbs.state.or.us/osha/pdf/hazards/2993-21.pdf

Gas Powered Concrete Mixer Safety

1. Transport and handle fuel only when contained in approved safety container.
2. Do not smoke when refueling or during any other fuel handling operation.
3. Do not refuel while the engine is running or while it is still hot.
4. If fuel is spilled during refueling, wipe it off of the engine immediately and discard the rag in a safe place.
5. Do not operate the equipment if fuel or oil leaks exist–repair immediately.
6. Never operate this equipment in an explosive atmosphere.
7. Avoid contact with hot exhaust systems and engines.
8. Allow all components in the engine compartment to cool before performing any service work.
9. Never leave mixer unattended while running.
10. Mix only concrete.
11. Never perform any work on the mixer while it is running.
12. Before working on the mixer, stop the engine and disconnect the spark plug wire(s) to prevent accidental starting. On electric models, disconnect the electric cord at the mixer.
13. Keep cowl closed and latched during the operation, close and latch cowl immediately after starting.
14. Keep hands, clothing and jewelry away from all moving parts.
15. Keep all guards in place, including drum guards.
16. Never place your hands or any solid object into the drum while the mixer is in operation.
17. Starting fluid (ether) is highly flammable, do not use or an explosion or fire may result.
18. Never operate unit in a poorly ventilated or enclosed area.
19. Avoid prolonged breathing of exhaust gases.
20. Engine exhaust fumes can cause sickness or death.

WEAR PROTECTIVE CLOTHING

1. Wear close fitting clothing and safety equipment appropriate to the job.
2. Prolonged exposure to loud noise can cause impairment or loss of hearing.
3. Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.
4. Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating machine.

PREPARE FOR EMERGENCIES

1. Be prepared if a fire starts.
2. Keep a first aid kit and fire extinguisher handy.
3. Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.

Eye Protection

1. Always wear splash goggles when operating mixer.

Towing

1. Warning: Do not tow the mixer with the drum in the dump position. Mixer may become unstable and tip over when hitting a curb, pothole, or other obstruction.
2. Warning: Always properly attach safety chains before mixer is towed. Maximum towing speed 55 MPH (90 km/hr). Reduce speed according to highway conditions.

3. Use safety chains and hitch pins with a safety pin.

Practice Safe Maintenance

1. Understand service procedure before doing work. Keep area clean and dry.
2. Never lubricate, service, or adjust machine while it is moving. Keep hands, feet, and clothing from power-driven parts. Disengage all power and operate controls to relieve pressure. Lower equipment to the ground. Stop the engine. Remove the key. Allow machine to cool.
3. Securely support any machine elements that must be raised for service work.
4. Keep all parts in good condition and properly installed. Repair damage immediately. Replace worn or broken parts. Remove any buildup of grease, oil, or debris.
5. Disconnect battery ground cable (-) before making adjustments on electrical systems or welding on machine.

Foot (Squaring) Shear

1. Obtain permission from your teacher before using the shear.
2. See that guards are in place.
3. Follow manufacturer's specifications as to gauge of sheet metal that can be safely cut.
4. Cut narrow strips of metal crosswise only.
5. Make sure that no one but you is inside the operator's zone.
6. Stand directly in front of machine.
7. Feed pieces of metal into shear from front (operator's position).
8. Keep your fingers away from clamp and blade.
9. Hold stock securely against guide.
10. Make sure the foot that is not being used to operate treadle is clear before pushing down on treadle.
11. Regulate pressure on treadle according to gauge and type of stock. Keep foot on treadle to ease its return to normal position.
12. Allow small pieces of metal being cut to drop to the floor or into a container.
13. Use care when picking up trimmings.

Hydraulic Shear (Ironworker)

Shearing

Pre-Operation

1. Read and understand the operational manual prior to use.
2. Wear safety glasses.
3. Shear only mild steel. The machine is designed to handle SAE-1020 steel. This is a grade of steel, not a thickness.
4. Keep the punch section clear.
5. Stay within rated shearing capacities. The ironworker is designed to shear mild steel.

Operation

1. Turn on motor switch.
2. Place the material to be cut between the shear blades.
3. Check that the area below the foot pedal is clear.
4. Always keep the guard in place and adjusted for minimum clearance.
5. Move hands away from shear blade. Make the shear stroke by depressing the foot pedal.
6. At the conclusion of the stroke, remove the foot from the pedal and the machine will return and stop in readiness for the next stroke.

Punching

Pre-Operation

1. Read and understand the instruction manual before operating the Ironworker.
2. Wear safety glasses.
3. Keep the shear section clear.
4. Check the punch securing nut, die, stripper and die at the start of each shift and periodically throughout the day for tightness.
5. Check the punch and die for alignment prior to punching the first hole and intermittently during the day.
6. Do not punch anything thicker than one punch diameter. Remember that the higher the grade of steel, the more punch power is required.
7. Punch full and complete holes, do not punch partial holes. The side thrust encountered in punching a partial hole can force the punch against the die and result in punch or die breakage.
8. Prior to operating the Ironworker, remove all tools or other objects from under the beam and punch ram. Failure to do so could result in danger to other personnel and to tools.
9. Stay within rated punching capacities. The ironworker is designed to punch mild steel.

Operation

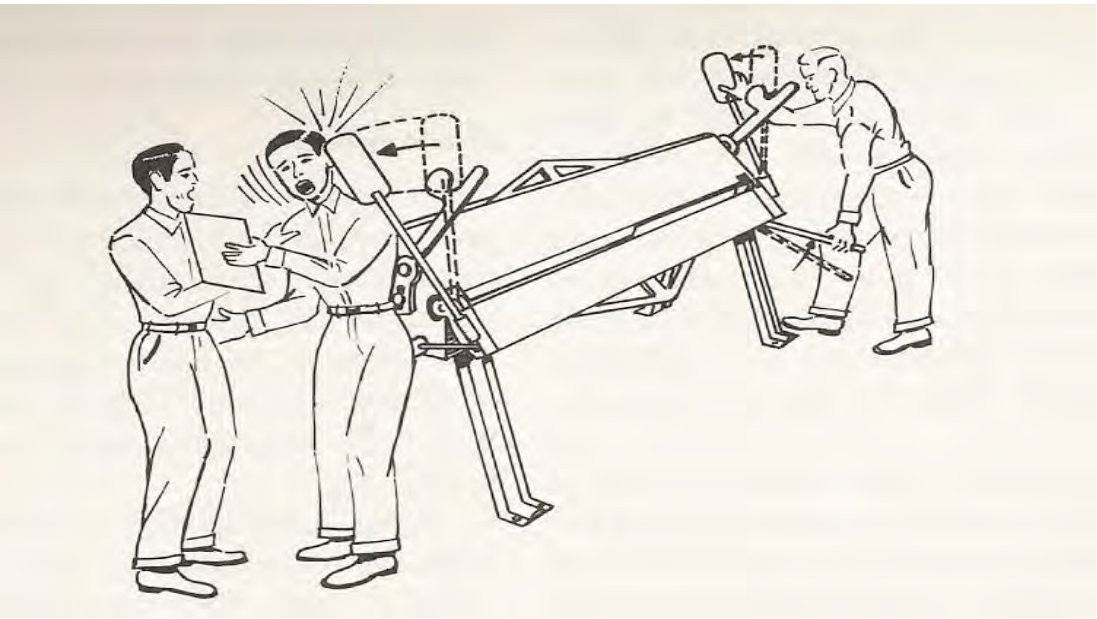
1. Turn on motor switch.
2. Place the material to be punched beneath the punch.
3. Check that the area below the foot pedal is clear.
4. Move hands away from the punch area. There is no need to hold the material being punched.
5. Depress foot pedal.
6. At the conclusion of the stroke, the foot should be removed from the pedal and the machine will return and stop in readiness for the net stroke.

Cornice Brake

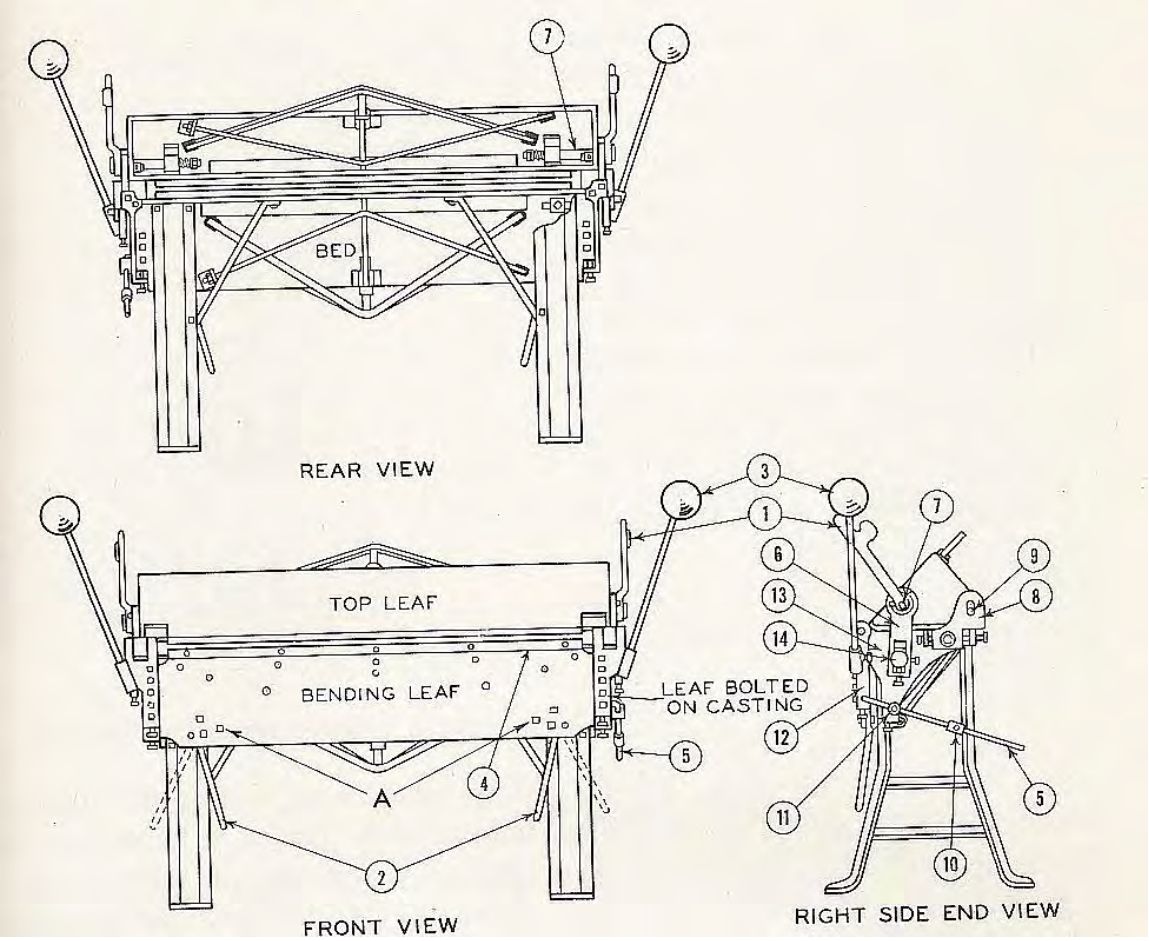
There are many types of brakes available to use when working with sheet metal. The cornice brake is the most commonly used. Safety is very important when it is time to use the brake.

Key Safety Practices

1. Do not place your hand in the cornice brake when someone else is operating the handle.
2. Make sure when going to use the brake that no one else is near the counterbalance balls to be hit by them.
3. If you are standing in front of the brake, stand back so that you will not be struck by the handles that project from the leaf when is it swung up.
4. Never bend rod or wire on any sheet metal brake. This will damage the blade and the bending leaf.
5. Never pound on a brake with any type of steel hammer. Always use a wooden mallet.



Before using the brake, the operator should be able to identify and know where and what each part is on the brake. A diagram of the brake is provided on the following page; the name is listed following the diagram.



The 3 major parts of the brake are the bed, top leaf and bending leaf (shown in the front and rear views).

Additional parts to the brake are numbered within the 3 diagrams, labeled with a number.

1. Clamping handle on each side for holding the sheet in position.
2. Two positions handle on each side, for operating bending leaf.
3. Balance weights, adjustable to make bending operations easier.
4. Upper bending leaf bar, removable when bending small locks.
5. Adjustable stop gage, used to form any desired angle.
6. Clamping link which operates the top shaft.
7. Top shaft.
8. Slot casting for adjusting the bending bar for various gages of metal.
9. Slot casting pin.
10. Adjusting stop slide on the stop gage for bending locks at various angles
11. Stop gage casting.
12. Bending leaf casting.
13. Bed end casting.
14. Link adjusting block.

Combustibles and Toxic Substances Safety[23]

Topic	Information
Combustibles and Toxic Substances	Many industrial supplies are flammable, explosive or subject to spontaneous combustion. Store combustible supplies and waste in fire safe containers.
Chemicals/Hazardous Substances	Follow procedures for safe handling, use, storage, and disposal of chemicals/hazardous substances, including emergency procedures and spill clean up. Label containers if you transfer the product from the original container. Know where to find Safety Data Sheets (SDS) and be able to answer the following questions for each product used: ❑ What are the hazards of the product you are using? ❑ How do you protect yourself from the hazards of the product? ❑ What would you do if an emergency occurred? ❑ Where can you find out more information about the product you are using?
Corrosives	Acids and caustics can burn skin and eyes causing permanent damage; they can also corrode metal so wear goggles, gloves, and protective clothing.
Flammables and Combustibles	Many industrial supplies are flammable, explosive or subject to spontaneous combustion, so store combustible supplies and waste in fire safe, closed containers, and keep them away from ignition sources.
Hazardous Waste	Follow procedures for handling and disposing of hazardous waste. Many counties provide for disposal of hazardous waste.
Poisons	Follow procedures for the safe use of poisons and label the containers if you transfer the product from the original container.
Substances Under Pressure (e.g. compressed gas cylinders)	Cylinders can explode if dropped or heated, so keep them away from ignition sources. Always follow procedures for safe use.
Wood Dust	Note that some wood dusts cause allergies (e.g., oak, mahogany, Western red cedar, redwood).

[23] Adapted from Heads Up for Safety

Plumbing Safety

Materials

The materials used in plumbing may expose the plumber to health hazards.

- Glues and solvents used with plastic pipe are of special concern. Use in well ventilated areas and avoid ignition sources. See SDS for more information.
- Pipe sealing compounds may also poses some hazards (see SDS).

Sanitation

Special precautions should be taken with working on existing sewer pipe. Sewers contain biological health hazards and possibly toxic chemicals. Personal protection equipment should be used and skin thoroughly washed after exposure.

Personal Safety Equipment

Safety glasses should always be worn to protect the eyes from flying debris, chemicals, and biological hazards. Gloves, boots, and coveralls may also be appropriate under some conditions.

General Safety Tips

1. Electrical tools should be used with extreme caution in wet areas. Follow safety instructions for the tool.
2. Always check for existing wiring and other pipes before boring holes for new pipes.
3. Torches used for soldering are hot and freshly soldered joints are also hot posing a burn hazard.
4. Care must be taken when soldering pipe in place not to burn the surrounding building. Have fire extinguishers on hand and always check charred surfaces for heat.
5. Spent fuel bottles should be disposed of properly.
6. Lead solder is not to be used for potable water plumbing.
7. Threading machines create sharp shavings, heat, and hot pipe. Use threading machines according to the manufacturer's directions.

Painting Safety Rules

Safety Data Sheets for materials should be consulted before using any paint materials as different materials have different safety concerns.

Preparation

1. Wear dust masks when sanding.
2. Wear eye protection at all times.
3. Never sand materials containing lead (old paint).
4. Use dust collection systems when possible.
5. Never grind in an area where painting is in progress (spark hazard).

When using stains, paints, and other finishes:

1. Wear approved eye protection.
2. Wear a respirator when spraying finishing materials.
3. Avoid breathing fumes from toxic materials.
4. Wear rubber or vinyl gloves to minimize risk of skin irritations when using a cloth or a pad to apply solvents, bleaches, stains, and finishes and when cleaning brushes.
5. Wash your hands after using any finishing materials.

Finishing Room Safety

1. Do all finishing in a separate, well-ventilated area specifically designed for finishing.
2. Make sure the proper types of fire extinguishers are available in the room.
3. For spraying, use a properly installed spray booth. Keep the spray booth clean and well maintained.
4. Keep the entire area clean and free from spills.
5. Never leave opened finishing materials unattended.
6. Never use tools or machines that can cause sparks or start a fire in the finishing area.

Using and Storing Paint and Solvents

1. Solvents emit dangerous fumes. Use only in a well-ventilated area.
2. Many solvents are extremely flammable. Keep all solvents away from sources of heat, sparks, and fires.
3. Store paint and solvents in their original containers. If, for some reason, this is not possible, be sure the new container is clearly labeled.
4. Be sure to read and obey the labels on each type of solvent (refer to SDS for complete list of hazards and precautions).

Health and Safety Guidelines for Painting[24]

In industry, the most popular method of applying paint is to spray it on, using compressed air, a high velocity airless sprayer or an electrostatic applicator. Paint can also be applied with brushes. The material itself is the primary hazard when painting. Painting may expose you to potentially dangerous chemicals which may damage your health. This guide outlines some of the hazards associated with painting and provides information on how to work safely while painting.

Choose paint materials with safety in mind. Never use materials which are unlabeled or their contents cannot be determined. Always follow the safety recommendations for the material being used.

Health Hazards

Overexposure to a substance means too much has been breathed in, swallowed or absorbed through the skin. The possible effects of overexposure to paint and the chemicals it contains vary according to the type of paint. Some health problems caused by overexposure to paint material are:

- drowsiness;
- dizziness/light headedness;
- disorientation;
- nausea/vomiting;
- eye and throat irritation;
- dermatitis;
- general allergic response such as hives;
- asthma-like wheezing with tightness in the chest;
- heavy metal poisoning (lead, chromium, nickel and cadmium); or
- nerve, kidney or liver damage.

A wide variety of ingredients are used in paints and thinners. These chemicals are not found in all paints, but you have probably come into contact with some of them at one time or an other. The following is a list of common ingredients of paints and thinners:

Pigments

- white lead
- red/brown iron oxide
- chromium oxide
- iron blue
- cadmium yellow
- lead powder

Solvents – thinners

- toluene
- xylene
- carbon tetrachloride

[24] Adapted from Government of Alberta, Human Resources and Employment (http://www3.gov.ab.ca/hre/whs/publications/pdf/ch004.pdf) and State Farm Insurance Fund safety materials found at: http://www.scif.com/safety/safetymeeting/SafetyMtgTopics.asp

- perchloroethylene
- isopropyl alcohol
- cyclohexanol
- n-amyl acetate
- methyl ethyl ketone
- cyclohexanone
- methylene chloride

Resins

- isocyanates (contained in urethane resins)
- epichlorohydrin (contained in epoxy resins)

You may already be familiar with the paints you use regularly, but do you know their possible harmful effects? Ask for the Safety Data Sheet (SDS) (see below) for each paint. These are available from the manufacturer or paint supplier. The SDS will describe the possible hazards and what precautions are needed. All of the above listed ingredients have standards for worker exposure.

Spray Painting Safety

Spray painting is a common and effective way to protect and beautify parts, products, vehicles, and buildings. Spray painting allows coverage of large areas with even coats of primer, paint, sealers, and other coatings. However, workers in spray painting operations need to recognize and guard against the hazard associated with spray painting processes.

Hazardous chemicals in coatings and solvents can enter the body several ways. Workers can inhale chemical vapors from spraying, absorb the chemical by skin contact or inject the chemical with high pressure spray painting equipment.

As proper ventilation is important when working with paint coatings, a spray booth is an excellent way to remove spray paint vapors and debris from a worker's breathing zone. Many coatings contain flammable substances that are aerosolized when sprayed through powered equipment and without proper ventilation, such as in a spray booth, these vapors can build up and create an explosion and fire danger. But to provide maximum protection, the spray booth must be properly maintained, including regular cleaning of filters and overspray. And to prevent sparking a flammable substance, smoking and other sources of flame near spray painting operations should be prohibited and tools should be properly rated and grounded for work in a spray painting area.

Because much of the equipment used for spray painting and surface preparation uses compressed air, workers should be aware that noise can be a risk, so should wear hearing protection when working with air powered tools.

How to Control Health Hazards

Following a few sensible rules can help to reduce exposure to chemical hazards.

Environmental Control

Whenever possible, painting or priming operations should be done in a spray booth or room. These areas have been designed to reduce exposure to paint vapors and additives – use them correctly. You should make sure that the ventilation in the spray booth or room is adequately maintained and working properly.

Before using the spay booth or room:

- turn on the ventilation system,
- check the spray booth filters and change if necessary, and

- turn on the make-up air unit.

When painting in an enclosed space (a room):

- provide outside ventilation air with fans or open windows,
- turn off ignition sources like wall heaters.

When painting:

- follow the equipment manufacturer's instructions,
- avoid using plastic drop cloths on the floor (slip hazard),
- never point a spray gun at yourself or anyone else,
- position yourself so the piece you are spraying is between you and the exhaust fan,
- do not over spray, and
- use appropriate personal protection.

Personal Protection

One positive step you can take to ensure continuing good health is to use personal protective equipment. Here is a brief description of some of the protective equipment available.

Respirators

Two types of respirators, the air-purifying and the atmosphere supplying, are commonly used in spray painting. IMPORTANT – you MUST use the correct type of respirator for the job being done and the chemicals being used.

The air-purifying type of respirator should be used only during exposure to those specific chemicals, or groups of chemicals, described on the respirator cartridge. These cartridges are good only for a limited time and must be replaced with new ones when:

- you can smell vapors in the mask,
- they become difficult to breathe through, or
- they have been used for their specific lifetime.

The atmosphere-supplying type of respirator must be used in some paint spraying operations, particularly with urethane paints or when painting in a confined space e.g. inside a tank.

REMEMBER — whichever respirator is used, it must FIT properly to ensure adequate protection (check the manufacturer's instructions). Respirator maintenance and cleaning is important. No one wants to use a dirty, leaky respirator which has been worn previously by someone else. Keep your respirator in good condition by cleaning and sanitizing it regularly. Store it in a clean place. Check it for pliability and signs of deterioration before you wear it. If the respirator needs repair, use only the manufacturer's recommended replacement parts. With a little thought, and a small amount of effort, your respirator will protect you for a long time.

Eye and Hearing Protection

Without good eyesight you cannot do your job properly — so why risk eye damage, or loss of eyesight from solvent spray or splashing? Wear your SAFETY GOGGLES to protect your eyes from paint materials as well as the particulates created during sanding and grinding.

Some painting equipment such as grinders and compressors create loud noise. Hearing protection is required when noise levels exceed 85 db.

Protective Clothing

Some of the chemicals you work with can injure skin or cause dermatitis. Coveralls and gloves prevent these chemicals from coming into contact with your skin, reducing the risk of damage. Wear your coveralls and gloves whenever working with chemicals. Clean your gloves and wash your coveralls regularly to prevent chemicals from accumulating, especially around the cuffs where they can easily come into contact with your skin. As an additional protective measure, use BARRIER CREAMS on your hands, face and neck. Check to make sure you have the correct barrier cream for the chemicals being used.

Fire and Explosion Hazards

Because of the danger of fire and explosion where paints which contain flammable solvents are being used, care should be taken to remove all potential sources of ignition before starting work. This means naked flames, cutting and welding torches, gas fired heaters and materials which may give off sparks, whether electrical, mechanical, friction or static, and there must be no smoking. Make sure the correct types of fire extinguishers are available at the work site.
REMEMBER different types of fires require different types of extinguishers.
IMPORTANT: Flammable materials are required to be stored in flammable materials storage cabinets. Many paint and solvents are flammable materials.

Dust and Preparation

Many painting projects require preparation of the materials to be painted. Preparation often involves sanding of the surface which creates a health hazard if dust masks are not worn. Ideally dust collection systems should be used to prevent large amounts of small particulates from entering the air.
Sanding and scraping of old paint may hold additional hazards if the old paint contains lead.

Things to do and not to do before painting

- **DO** Post “No Smoking” and “No Welding” signs.
- **DO** Remove portable lamps and heaters from the area.
- **DO** Make sure painting is done away from naked flames, sparks, non-explosion proof motors or any other source of ignition.
- **DO** Check the ventilation system to make sure it is on and working correctly.
- **DO** Electrically ground all spraying equipment.
- **DO** Make sure approved respirator, eye goggles and any other protective equipment required for the job are worn.
- **DON’T** Smoke.
- **DON’T** Take more paint out of the store room than you can use in one day.

Solvents

Solvents are so common in many work places that workers forget how dangerous they are. A solvent can be generally described as a substance, usually a liquid, that is used to dissolve another substance. Although solvents can be used safely, health problems can result from skin contact with solvents or from inhalation of their vapors. In addition to the health hazards, many solvent vapors are flammable and explosive.

One of the most common health hazards associated with exposure to solvents is dermatitis. Contact dermatitis can develop from a single or from multiple exposures. It can leave the skin susceptible to a short-term infection or to a chronic condition. Exposure can also result in sensitization to the solvent, which is a delayed allergic reaction that often becomes more severe with subsequent exposures.

One big danger with solvents is that they can cause trouble before you realize what's happening. Depending on the type and concentration of the solvent, exposure effects can range from mild respiratory irritation to severe damage to body organs and systems. In extreme cases, overexposure to solvent vapors can cause respiratory failure and death.
When working with solvents, it's important to know what solvents are being used and what steps should be taken to protect against harmful or dangerous exposures. To optimize safety follow these suggestions:

1. Know what solvents you're working with.
2. Read the labels and the material safety data sheets of the solvents. They list the hazards, health effects, and safe handling procedures.
3. Make sure the workspace is properly ventilated.
4. Use recommended gloves, eye and face protection, boots, other protective clothing, or barrier creams as required.
5. If respiratory equipment is used, make sure it gives appropriate protection for the exposure.
6. Take care when pouring solvents from one container to another, as fire or explosions can occur from static electricity buildup.
7. Clean up solvent spills promptly.
8. Never wash your hands with solvents.
9. Prohibit welding, cutting, soldering, and other sources of ignition in areas where solvents are used.
10. Store flammable solvents in well-ventilated areas constructed of fire-resistant materials.
11. Ground and bond all tanks and equipment for storage.
12. Install readily accessible fire extinguishers in storage and work areas.

As with other toxic substances in the workplace, the preferred methods of hazard control are substitution of a less toxic substance in an operation, local exhaust ventilation, and enclosure.

Ladder Safety

1. Ladders are commonly used for painting. Ladder safety begins with selecting the right ladder for the job and includes inspection, setup, proper climbing or standing, proper use, care, and storage. This combination of safe equipment and its safe use can eliminate most ladder accidents.
2. Always check a ladder before using it. Inspect wood ladders for cracks or splits. Inspect metal and fiberglass ladders for bends and breaks. Never use a damaged ladder. Tag it "Defective" and report it to your supervisor/teacher.
3. When setting up a ladder, make sure it's straight and sitting firmly on the ground or floor. If one foot sits lower, build up the surface with firm material, don't set it on boxes, bricks or other unstable bases. Lean the ladder against something solid, but not against a glass surface. Make sure the ladder is placed at a safe angle, with the base away from the wall or edge of the upper level about one foot for every four feet of vertical height. Keep ladders away from doorways or walkways, unless barriers can protect them.
4. Keep the steps and rungs of the ladder free of grease, paint, mud or other slippery material. And remember to clean debris off your shoes before climbing. Always face the ladder when climbing up or down, using both hands to keep a good grip on the rails or rungs. Never carry heavy or bulky loads up a ladder. Climb up yourself first, and then pull up the material with a rope or bucket.
5. Many ladder accidents occur because of slipping or skidding. You can prevent these accidents by equipping the ladder with non-slip safety feet, blocking its base or tying it to a sound, permanent structure.
6. Overreaching is probably the most common cause of falls from ladders. A good rule is to always keep your belt buckle inside the rails of a ladder. Don't try to move a ladder while you're on it by rocking, jogging or pushing it away from the supporting wall.
7. When you've finished the job, properly store the ladder so it won't be exposed to excessive heat or dampness and will be in good condition for the next time.

Livestock Safety Topics

Working Safely Around Animals[25]

One in three injuries on the farm/ranch involves handling or contact with large animals. Animal movements are generally unpredictable, so learn to recognize the signs of fear, pain and stress in the animals with which you work.

- ❑ APPROACH ANIMAL SAFELY: The proper approach to a large animal is critical to working with them safely. Most large animals can see at wide angles around them, but there is a blind spot directly behind their hind quarters beyond which they cannot see. Any movement in this "blind spot" will make the animal uneasy and nervous. The safest approach is to "announce" your approach through a touch to their front or side. Most large animals will kick in an arch beginning toward the front and moving toward the back. Avoid this kicking region when approaching the animal.
- ❑ SEPARATE CATTLE SAFELY: As one large cow can weigh up to 1500 lbs, it is not a good idea to try to manually separate cows using gates or boards. A frightened cow or horse will plow right over you. It is safer to use proper handling facilities made specially for separating large animals. Most animals will be more cooperative in moving through a chute that has minimal distractions.
- ❑ LEAVE YOURSELF AN "OUT": When you are inside a handling facility or milking lane, always leave yourself a way to get out if it becomes necessary. Try to avoid entering a small area enclosed with large animals unless it is equipped with a mangate that you can get to easily.
- ❑ BE CAREFUL AROUND SICK/HURT ANIMALS: When working with sick and hurt animals be sure to protect yourself from any animal-borne diseases such as undulant fever, tetanus, rabies, etc. Wear rubber gloves and other protective clothing for protection and practice good hygiene by washing your hands and face after handling animals.
- ❑ PRACTICE GOOD HOUSEKEEPING: Keeping your work area clean and free of debris will help provide a safe working environment. Check for and eliminate any sharp corners or protrusions in walkways. Check to ensure that all latches and levers can't fly open easily. Clean concrete ramps and floors regularly to prevent slips and trips. Keep pitch forks and other sharp tools stored properly out of walkways.
- ❑ MAINTAIN EVEN LIGHTING: Shadows mixed with light spots inside handling facilities will increase the animal's fear and tension. Try to keep the lighting in these moving areas dispersed evenly.
- ❑ WORKING SAFELY WITH DAIRY CATTLE: Dairy cattle are generally more nervous than other animals, so it's important to approach these animals gently to avoid startling them. Once you have moved dairy cattle into the milking stalls, give them a moment to adapt to the new environment before beginning your operation.
- ❑ SAFELY WORKING WITH SWINE: Though hogs are not normally aggressive animals, they can become dangerous animals if threatened, especially sows protecting her young. The best method by which to move hogs is by guiding hogs combined with gates and/or panels. Announce your approach to hogs as you do with other animals. Do not walk up to them quietly and surprise them.

[25] Adapted from AgSafe.org

Handling Animals[26]

1. Anyone who works with livestock knows each animal has its own personality. Animals sense their surroundings differently than humans. Their vision is in black and white, not in color. They also have difficulty judging distances. And differences exist between the vision of cattle, swine and horses. For example, cattle have close to 360-degree panoramic vision. A quick movement behind cattle may "spook" them.
2. Animals have extremely sensitive hearing and can detect sounds that human ears cannot hear. Loud noises frighten animals, and research proves that high-frequency sounds actually hurt their ears. These factors explain why animals are often skittish and balky, particularly in unfamiliar surroundings.
3. Watching animals for signs of aggressiveness or fear alerts you to possible danger. Warning signs may include raised or pinned ears, raised tail or hair on the back, bared teeth, pawing the ground or snorting.
4. Although handling methods may vary greatly for different types of livestock, there are some generally accepted rules for working with any animal:
    a) Most animals will respond to routine; be calm and deliberate.
    b) Avoid quick movements or loud noises.
    c) Be patient; never prod an animal when it has nowhere to go.
    d) Respect livestock - don't fear it!
    e) Move slowly and deliberately around livestock; gently touch animals rather than shoving or bumping them.
    f) Always have an escape route when working with an animal in close quarters.
5. Safety Reminders
    a) Liquid manure holding facilities should be secured against entry. Outdoor lagoons and ponds should be fenced.
    b) Good housekeeping is essential, not only for your personal safety, but also for the health and well being of your stock.
    c) Keep children away from animals, particularly in livestock handling areas.
    d) Most male animals are dangerous. Use special facilities for these animals and practice extreme caution when handling them.
    e) Be calm and deliberate when working with animals. Always leave yourself an "out" when working in close quarters.
    f) Respect all animals. They may not purposely hurt you, but their size and bulk make them potentially dangerous.
    g) Most animals tend to be aggressive when protecting their young; be extra careful around newborn animals.
    h) Stay clear of animals that are frightened or "spooked." Be extra careful around strange animals.
    i) Monitor entry into your operation; sales and service personnel could bring diseases from other farms.
    j) Keep facilities in good repair. Chutes, stalls, fences and ramps should be maintained regularly.

[26] Adapted from Animal Handling Safety Considerations. David E. Baker and Rusty Lee University of Missouri Extension See at: http://www.cdc.gov/nasd/docs/d000801-d000900/d000876/d000876.html

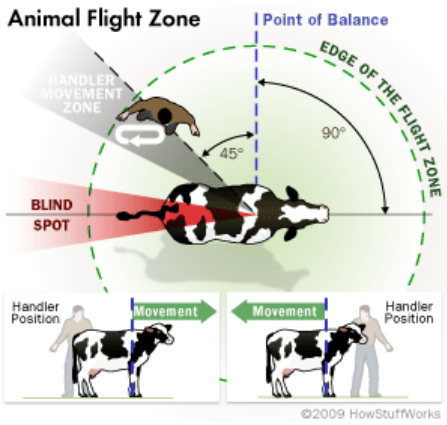
Cattle Safety[27]

In order to safely handle cattle it is important to understand their behavior patterns. Understand the behavioral principles of the flight zone and the point of balance. When cattle are moving where you want them to move, back up and retreat from inside the flight zone. When they slow down or stop moving, reenter the flight zone to get them moving again. This is the principle of pressure and release.

Flight Zone

The flight zone is the animal's safety zone, and its size varies depending on the animal's degree of wildness or tameness. The size of the flight zone is determined by three interacting factors:

1. Genetic traits (excitable versus calm),
2. Amount of contact with people (see them everyday or only twice a year)
3. Quality of the contact with people (negative versus positive).



1. Handle cattle calmly. No yelling or screaming.
2. Beware of the lone animal. An animal separated from its herd mates is a major cause of accidents involving gates.
3. Keep equipment well maintained. Worn-out latches on squeeze chutes have caused serious accidents when they have suddenly come loose. Gates should swing freely and have well-maintained latches that are easy to latch and unlatch.
4. Cattle-handling facilities must have nonslip flooring in high traffic areas such as squeeze chutes, scales, crowd pens and loading ramps. Animals panic when they slip.
5. Only half fill the crowd pen leading to the single-file chute. Cattle will move easier and be less likely to shove a gate back into a person's face when not overcrowded.
6. Wait until the single-file chute is almost empty before putting more cattle into the crowd pen. The cattle will move into the lead-up chute that leads to the squeeze more easily if they're able to pass through the crowd pen and are not forced to wait.
7. Remove distractions from corrals and chutes that make cattle balk or turn back. Get down in the chute to see what cattle are seeing.

[27] Adapted from Beef Magazine. Available at http://beefmagazine.com/beef-quality/cattle-handling/0101-safe-makes-safety

Horse Safety[28]

1. Horses detect danger through their vision, sense of smell and keen sense of hearing.
2. They have wide-angle vision, but they also have blind spots directly behind and in front of themselves.
3. Always work with calm but deliberate movements around horses. Nervous handlers can make horses nervous, creating unsafe situations.

Approaching the Horse

1. When catching a horse, approach from its left shoulder. Move slowly but confidently, speaking to the horse as you approach. Read the horse's intention by watching its body language.
2. Be careful when approaching a horse that is preoccupied, such as when its head is in a hay manger.
3. When approaching a horse in a stall, speak to the horse to get its attention and wait until it turns and faces you before entering and make sure the horse moves over before you walk in beside it.
4. Speak to your horse and keep your hands on it when moving around it. Even if a horse is aware of your presence, it can be startled by quick movements.
5. When approaching from the rear, advance at an angle speaking to the horse, making sure you have its attention. Touch it gently as you pass by its hindquarters.

Leading the Horse

1. Hold the lead line with your right hand, 8 to 10 inches away from the horse's head, while holding the end, or bight, of the line with your left hand. Always use a lead line so you have this "safety zone" and to prevent getting a hand caught in the halter.
2. Teach your horse to walk beside you so that you are walking at its left shoulder, with your right elbow near the horse's shoulder so you can anticipate its actions.
3. Do not let the horse "walk" you. Do not allow it to get behind you either, as it could jump into you if spooked.
4. To lead a horse through a doorway, you should step through first, then quickly step to the side out of the horse's way. Keep an eye on it, as some horses try to rush through narrow spaces.
5. Never wrap any piece of equipment attached to a horse around your hand, even with small loops, as it could wrap around the hand and cause serious injury.
6. After you remove the halter, make the horse stand quietly for several seconds before letting it go completely. This will help prevent the horse from developing a habit of bolting away and kicking at you in the process.
7. Some horses can become sour and begin nipping at you if they anticipate discomfort during grooming. Do not hurry the grooming procedure, especially with a young or spooky horse. Stay near the horse and keep a hand on it at all times so you can anticipate its movements. •
8. Do not climb over or under the lead line of a tied horse. The horse may pull back and cause you to trip over the line, and you will have no quick escape should the horse lunge forward, paw or try to bite. Never walk under the belly of any horse.

[28] Adapted from Cornell Agricultural Health and Safety Program. Available at https://www.aphis.usda.gov/emergency_response/downloads/health/Appendix%203-7-A%20Animal%20Handling.pdf

Sheep

Behavioral Tips[29]

1. Sheep react to their surroundings, this includes the working environment and facilities; the following suggestions will help make the experience positive:
2. Sheep like routine, so be patient when introducing something new.
3. Sheep reactions are predictable, so use them.
4. Sheep react negatively to loud noises and yelling.
5. Sheep will bunch up in corners to protect themselves.
6. When moving, gathering or sorting sheep, the more efficient the operation the better; wool grabbing and rough handling will cause bruising.
7. Sheep tend to move in the opposite direction of the handler.
8. Sheep have a flight zone, determine what this is for your flock.
9. Sheep move best when not afraid, so work slowly and calmly.
10. Sheep do not like to move into the darkness; place a chute facing a well lit area.
11. Sheep move better on a flat surface or uphill.
12. Sheep will move towards other sheep.
13. Sheep will move to a partially full pen.
14. Sheep will move better through long, narrow pens and chutes rather than square pens and wide chute systems.
15. Sheep resist moving from one type of surface to another.
16. Sheep have no depth perception, so shadows, dark surfaces and water are an issue.
17. Sheep fear new visual objects.

Handling Tips[30]

In order to perform procedures like hoof trimming, crutching, teeth inspections, wool quality tests and ear tag checking, a sheep will have to be caught and restrained. *Catch and throw* is a good method of restraining an individual animal.
It is best to start in a small clean yard with the individual animals that you wish to restrain. Take care not to pull the wool throughout the procedure as this can bruise the sheep and damage the wool. Rams should only be handled by an experienced person, as they are larger and may be aggressive especially during the breeding season.

Catch and restrain

Catch the sheep with one hand on the rump and the other under the muzzle, keeping the sheep as close as possible to your legs.
If necessary, straddle the sheep to properly restrain it.

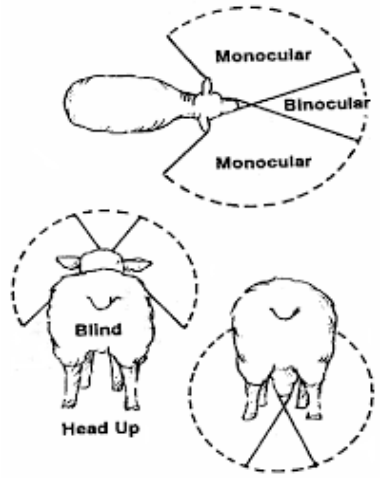
Catch and throw

1. Catch the sheep with one hand on the rump and the other under the muzzle.
2. Turn the sheep's head around as far as possible away from yourself.
3. Pivot yourself backwards around with the sheep following. The sheep will go down on its rump.

[29] Understanding Sheep Behavior. Available at http://www.sksheep.com/documents/Ex_Understanding_Sheep_Behaviour.pdf
[30] Animals in Schools. Available at http://nswschoolanimals.com/sheep/sheep-handling/

4. Lean the sheep against your knees and apply pressure with both knees in order to secure the sheep in a grip.
5. To release the sheep, let it drop onto its front legs. It will quickly regain a standing position.

The area in the back of the sheep's head is a blind spot when their head is raised. If a sheep is approached from the rear, a handler can remain undetected visually and have a better chance at catching the animal. With its head down in a grazing position the sheep can see in all directions; a good defensive adaptation whereby the sheep can see predators' from all sides while grazing.



Swine Safety[31]

General animal husbandry

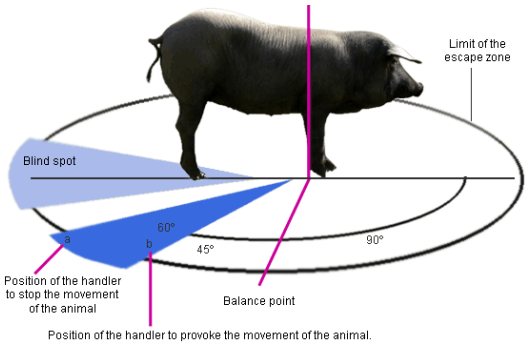
1. Providing facilities to protect and shelter pigs from weather extremes while protecting air and water quality in the natural environment
2. Providing well-kept facilities to allow safe, humane, and efficient movement of pigs
3. Providing personnel with training to properly care for and handle each stage of production for which they are responsible with zero tolerance for mistreatment of swine in their care
4. Providing access to good quality water and nutritionally balanced diets appropriate for each class of swine
5. Observing pigs to make sure basic needs for food and water are being met and to detect illness or injury
6. Developing herd health programs with veterinary advice
7. Providing prompt veterinary medical care when required
8. Using humane methods to euthanize sick or injured swine not responding or not likely to respond to care and treatment in a timely manner
9. Maintaining appropriate biosecurity to protect the health of the herd.
10. Providing transportation that avoids undue stress caused by overcrowding, excess time in transit, or improper handling during loading and unloading

Handling

1. If the pig appears distressed during handling, it must be permitted to rest and recover without prodding.
2. Pigs must never be prodded in sensitive areas such as the eyes, nose, anus, testicles, etc.
3. Funnel-shaped pens should not be used to load pigs because pigs often continue to press forward.
4. Pigs will stop when a solid barrier is placed in front of them.
5. Other useable tools for moving pigs include large flags or plastic paddle sticks.

Vision

A pig's range of vision is more than 300 degrees. Although this allows them to see behind themselves without turning their heads, it also causes them to be sensitive to sharp contrasts in light and dark. Pigs may balk and be reluctant to move if they encounter shadows, puddles, bright spots, a change in flooring type or texture, drains, metal grates, or flapping objects.



[31] Adapted from Swine Care Handbook. Available at http://porkcdn.s3.amazonaws.com/sites/all/files/documents/AnimalWell-Being/swine%20care%20handbook%202003.pdf

Safe Use of Livestock Medicines[32]

The Key Points

Misuse of livestock medicines can cause various problems. This booklet provides producers with a detailed guide to the best practices required. The critical points to observe are:

1. Develop a herd health plan to minimize disease problems in the first place.
2. Use only approved products licensed for use with the particular species.
3. Only purchase from suppliers authorized to sell the particular remedy.
4. Administer medicines only if you are competent to do so.
5. Read the label carefully before you treat the animal.
6. Note manufacturer recommendations, precautions, contraindications and warnings.
7. Adopt good hygiene practices when injecting animals.
8. Check and note the withdrawal period for the livestock remedy.
9. Record the relevant details in the animal records.
10. Do not sell or supply milk or livestock until all withdrawal periods have elapsed.
11. Provide good handling facilities for safe administration of livestock medicines.
12. Store medicines in a suitable secure place.
13. Dispose of unused medicines and used needles in a safe manner.

Introduction

Animal medicines, including vaccines, play an important role in the control and prevention of animal disease. There are strict controls governing the authorization, distribution and use of animal medicines. Ensuring product safety at all points in the chain from the `manufacturer to the animal' is essential. This includes the supply, storage, use and disposal of animal medicines.
Adherence to best practice is a key requirement at all points in the food supply chain. Producers are required to demonstrate best practice in regard to animal medicines.

Medicines: The Potential Risks

Food safety can be compromised if livestock medicines or veterinary equipment are misused or best practice is not adopted. Three types of food safety hazards are associated with livestock medicines:

- Chemical
- Biological
- Physical

Chemical Hazards

Residue contamination is the most likely chemical hazard. Medicine residues can render a product (milk, meat) unsuitable or unsafe for its intended use.

1. Once a residue occurs it cannot be removed.
2. It is vital to be aware of and fully comply with the stated withdrawal dates for a particular remedy.

[32] Adaped from Safe Use of Livestock Medicines for Cattle and Sheep Farms. Avaliable at: http://www.teagasc.ie/publications/2003/vetbooklet.htm

3. It is **an offence not to observe the proper dose rate and withdrawal period** stated on the product label.
4. It is illegal to sell animals or produce before the withdrawal period for any animal remedy administered has expired.

Biological Hazards

Bacterial or parasitic resistance to medicines can pose an overall threat to human and animal health. Resistance can occur if human or livestock medicines are misused or overused.

- Prevention is the best policy. Draw up a herd health plan. Use good management practice and strategic use of medicines to minimize disease and parasites.
- Avoid unnecessary use of medicines. Use the right product to treat an ailment. Give the correct dose rate. Complete the full treatment program if using an antibiotic or anti-microbial medicine.

Physical Hazards

Broken needles in a carcass could give rise to food safety hazards. The frequency of needles entering the food chain is extremely low. The damage potential is very high if needles do enter the food chain.

Other Hazards

While food safety is the primary concern; other significant hazards can also occur. These include risks to personal safety, animal health and welfare, and the environment.

1. Producers should handle all veterinary medicines with care. Extra caution is required for products where user contact with the medicine can readily occur. This includes sheep dips, pour on medicines and certain vaccines.
2. Unauthorized mixing of medicines together, or administering certain drugs at the same time could potentially cause harmful interactions for the animal. The stated withdrawal periods may also be affected.
3. Needles used more than once are not sterile and can damage or blemish meat. Damaged or burred needles may also damage meat and inflict pain to the animal.
4. Forceful use or misuse of dosing guns can damage the animal's mouth and pharynx. Care is required with worming bullets or boluses; significant injuries or even death can occur if calves are below the recommended age or weight or if incorrect applicator guns are used. Rough use of intra-mammary tubes can damage the teat orifice and canal. Broken needles compromise animal welfare if not removed.
5. Careless storage or disposal of livestock medicines can harm the environment. Particular care is required with the disposal of spent sheep dips.

The following guidelines will minimize the risk of serious food safety, animal health, environmental and personal safety hazards arising.

Guidelines for Safe Use

Correct use of medicines is in the producer's and the customer's interest. A number of points should be noted when administering medicines.

Use the right product

1. Always check that the medicine is licensed for use for the particular category or species of animal involved and is suitable for the condition being treated.
2. Medicines come in different formulations; a cattle wormer may be totally unsuitable for sheep because the concentration of active ingredient is different. Many fluke doses are unsuitable for cows near calving or in milk.
3. There are different classes of wormers and flukicides available. The particular active ingredient in wormers/flukicides may determine when and how the product should be used. Some flukicides for example are most effective against mature fluke only while others are effective against immature and mature fluke. If necessary get advice on the product most suited to your needs.
4. Only purchase from a supplier authorized to sell the particular remedy.
5. Do not purchase medicines if the label has been tampered with.
6. Do not `borrow' prescription medicines (e.g. antibiotics) from other producers.
7. Never use a prescription medicine on animals other than those it was prescribed for unless you have clear approval from a vet.
8. Check the expiry date on the product. Do not use any medicine past its expiry date. Observe any in-use expiry dates. Some vaccines may lose potency within hours of opening. Other medicines may lose potency within days or weeks of opening.
9. Consult your vet on the most appropriate intramammary antibiotics for mastitis control/treatment in your herd. Have a planned mastitis control program targeting all factors likely to impact on herd mastitis levels.

Administer with care

1. Read all the instructions carefully, as they contain important information.
2. Comply with the manufacturer's dosage guide. Under dosing increases the risks of parasites or bugs developing resistance to livestock medicines. Overdosing may increase the risk of residues occurring or adversely affect animal health.
3. Competent individuals should administer livestock medicines (e.g. someone who can adequately assess or check animal liveweight to determine the dose rates and follow the manufacturer's instructions).
4. Always complete the specified treatment program if using antibiotics or an anti-microbial.
5. Do not mix medicines or wormers with other medicines or mineral vitamin supplements.
6. Injectable medicines are normally given as subcutaneous (under the skin) or as intramuscular injections. Follow the manufacturer recommendations.
7. Do not inject cattle in the valuable meat areas. There is always a risk of an abscess forming or damage/blemishes occurring. The most valuable cuts are in the loin area and the hindquarter area. Forequarter cuts (shoulders/neck) are generally less valuable.
8. In the rare event that a needle breaks during an injection the needle should be removed promptly. Veterinary assistance may be necessary to remove broken needles in a safe, hygienic manner. A broken needle can lead to significant hazards further along the food chain. It also compromises basic animal welfare requirements.

Provide Suitable Equipment and Facilities

1. Proper livestock handling/restraining facilities are vital to administer medicines safely and correctly.
2. Check that dosing or injection guns are properly calibrated to deliver the correct dosage.

3. Damaged or worn equipment (e.g. dosing guns) can inflict unnecessary stress and injury on stock and constitute an animal welfare hazard. Do not use excessive force or handle animals roughly.
4. Make sure animals are at the recommended age or weight if using boluses or bullets. Use the correct applicator gun.
5. Replace needles if they are damaged.
6. Follow manufacturer or veterinary instructions in relation to needle size (gauge) required for specific situations.

Ensure Good Hygiene

1. Use a sterile needle for each injection if at all practical. Used needles can cause tissue damage and inflict pain on the animal.
2. Use disposable needles and syringes if treating potentially infectious or transmissible diseases.
3. Make sure that the injection site is clean and the injection needle is kept clean. Use a separate clean sterilized needle to fill the syringe from the bottle or container if giving more than one injection.
4. Sterilize needles and syringes in boiling water for 20 minutes (or use alcohol or a suitable sterilizing agent). Alcohol or disinfectants are not recommended to sterilize needles or syringes if using certain vaccines. Check the manufacturers' recommendations on this point.
5. Automatic reloading injection guns are widely used for overall herd or flock treatments (e.g. flock vaccination). Manufacturers generally give specific recommendations on how often needles should be changed, how needles are sterilized and how the automatic syringe is calibrated. Follow these instructions carefully.

Watch the Withdrawal Date

1. Always read the label and check the product withdrawal period. The information on product labels and literature can change as new information becomes available. The product authorization criteria or maximum permitted residue levels in meat or milk may have been amended.
2. Record the use of the medicine in the animal records. Comply with the withdrawal period.
3. Producers should segregate the animal identity cards of treated cattle for the duration of the remedy withdrawal period. This will prevent accidental or inadvertent sale of animals within the withdrawal period.
4. Use a marking stick or spray to identify treated livestock that are not normally tagged or individually identified.
5. Animals that have failed to respond to medication for a particular condition (e.g. mastitis in cull cows) must not be sold until the withdrawal period for medicines administered has elapsed.
6. Ensure that residue contaminated milk **does not** enter the milk bulk tank or food supply chain. Do not feed this milk to any livestock.
7. Remember residue monitoring is carried out on an ongoing basis at meat and dairy processing plants. Accidents or negligence could prove to be a costly mistake and may be harmful to consumers.
8. Make sure that someone on your farm is personally responsible for ensuring that withdrawal periods are observed.

Protect Yourself

1. Ensure that students, family members and farm employees are aware of any risks to personal health and safety.
2. Inexperienced students should be directly supervised until they become competent.
3. Manufacturer instructions and safety guidelines (e.g. protective clothing, gloves and masks) should be complied with.
4. Personnel should not eat food or smoke while handling and administering livestock medicines.
5. If splashed (e.g. skin splashes, splashes in the eye); follow the manufacturer guidelines. If medicines are accidentally ingested or swallowed consult your family doctor. Specify the name of the product involved, the active ingredient and any manufacturer recommendations given.
6. Keep a list of emergency phone numbers on hand (e.g. family doctor, local hospital, veterinary surgeon, and pharmacist).
7. Suitable handling and restraining facilities are essential to minimize the risk of physical injury to the animal and the operator.
8. Take extra care when treating sick animals. They may carry bugs that can spread to you. Wear protective clothing if necessary. Cover or protect any open wounds or sores likely to come in contact with the animal. Practice good hygiene–always wash your hands after handling animals and before eating food.

Sample Safety Quizzes

Safety tests and quizzes are a common means of testing for safety comprehension. Remember the goal of safety instruction is safe practice so testing is only one part of the strategy. Tests and quizzes should be aligned with safety lessons. Some common practices with safety tests are:

- Have the student correct the wrong answers, perhaps with a written explanation of the correct answer.
- Require a perfect score before the student is allowed to work with a specific tool.
- File the test to document safety training.
- Have the student take home the test and have a parent sign it.

The following tests should only be used as examples and are not aligned specifically to the safety training materials provided in this guide. It is important to remember that safety training and necessarily the safety test needs to be tailored to the units of instruction used by the teacher. Quizzes are not provided for all the topics list in the guide.

Herbicide Safety Quiz

1. You should always _____ the herbicide label before you use it.
    a. Read
    b. Write
    c. Throw away
2. You should be familiar with current federal and state regulations regarding herbicides before use.
   T/F
3. You should always wear protective clothing when applying herbicides.
   T/F
4. You should eat and drink while applying herbicides.
   T/F
5. You should store herbicides and pesticides together.
   T/F

Pesticide Safety Quiz

1. You should always read the pesticide label before application?
   T/F
2. Personal protection equipment should always be worn when working with pesticides.
   T/F
3. Sunglasses are sufficient eye protection when working with pesticides.
   T/F
4. If a pesticide label says you should not wear gloves, should you still wear them?
   a. Yes
   b. No
5. You should protect your hands when you _____ pesticides.
   a. Mix
   b. Load
   c. Apply
   d. All of the above
6. Respirators need to be worn when the pesticide _____ states that it is required.
   a. SDS
   b. Label
   c. Permission slip
   d. A and B
7. Long sleeve shirts and long pants should always be worn when applying pesticides.
   T/F
8. Always wash your hands with _____ and _____ after pesticide use.

Heat Stress Quiz

1. List 3 factors that can affect your risk of heat stress:

_____, _____, _____.

2. List 3 symptoms of heat stress:

_____,_____,_____.

3. How can heat stress be treated?

_____

_____.

4. In order to minimize the risk of heat stroke you should wear:
    a. Dark clothing and tight fighting clothing
    b. Light-colored clothing and loose fighting clothing
    c. Breathable fabric
    d. Both b and c

5. To help reduce heat stress you should drink _____ every 20 minutes.

Skid Steer Loader Safety Quiz

1. You should always conduct a safety check before entering a skid loader?
   T/F
2. You should always use the controls as handholds or steps when entering the vehicle?
   T/F
3. Operate the loader from the _____, never from the outside.
4. You should never exceed the manufacturer's specified load limit?
   T/F
5. You should always _____ distribute a load.
   a. Evenly
   b. Quickly
   c. Unevenly
6. You should always set the fork attachments/bucket on the ground before exiting the vehicle?
   T/F
7. You should avoid excessive speeds?
   T/F
8. For best stability you should travel/turn with the bucket in the _____ position.
   a. Highest
   b. Best
   c. Lowest
   d. Lightest
9. You should never allow passengers in the skid loader with you?
   T/F
10. You should always wear your seatbelt?
    T/F

Shop Safety Quiz[33]

Name: _____

Purpose: The purpose of the quiz is to provide an assurance that you have a basic understanding of safety in shop operations and that through practice you will improve skills and confidence.

Directions: Circle the answer that you believe is correct. The completed quiz will be discussed with an opportunity to correct misunderstood items. Be sure to sign the statement at the end of the quiz. Practice safety at all times. Your quiz will be kept on file.

General Safety Rules

1. T F Approved eye protection must be worn at all times when working in the AGET Shop.
2. T F Clothing of <u>any</u> type may be worn as long as it is work clothing.
3. T F All special set-ups must be checked by the instructor before the power is turned on.
4. T F Inspection of power tools for satisfactory operating conditions is not necessary immediately after another person has used it.
5. T F Open-toed shoes are not permissible while working in the AGET shop.
6. T F Work areas must be left clean and damaged tools repaired or reported to the instructor before you can consider the area safe to leave.
7. T F Exits must be kept clear at all times.
8. T F Long hair may be worn in any style that the student enjoys.
9. T F The choice of the tool for the job is not a significant consideration in safe shop operations.
10. T F Sharp cutting tools are safer than dull ones.
11. T F Properly grounded outlets and equipment are essential for shop safety.
12. T F All injuries, no matter how small, must be reported to the instructor.
13. T F All guards must be in place, in operating order, and used at all times.
14. T F Students can wear any jewelry they wish in the Ag. Mechanics shop.
15. T F Any liquids spilled on the floor should be wiped up immediately.
16. T F Loose hammer heads are not a hazard in the shop.
17. T F Chisels and punches are allowed to have mushroomed heads as large as 1/8".
18. T F Files without handles are permitted for some jobs.
19. T F Screwdrivers may also be used as pry bars.

The Drill Press

20. T F Remove chips from drill press vise or table by blowing with an air hose.
21. T F Drills properly ground and sharp will reduce the need for excessive pressure and avoid breakage when drilling.
22. T F When the work is securely clamped to the drill press table, the danger of binding and spinning material is much less.
23. T F Small or large pieces may be held freehand for drilling.
24. T F The chuck key should be left in the chuck when starting the drill press.

[33] Adapted from materials in use by Dr. Bill Kellogg (Cal Poly, SLO) and Mike Spiess (CSU, Chico).

The Grinder

25. T F The tool rest should be adjusted securely at not more than 1/8" from the wheel.
26. T F It is safe to grind small nuts and bolts held in your fingers.
27. T F Rags or gloves may be used to hold small parts.
28. T F The grinder RPM may exceed the RPM marked on the grinding wheel.
29. T F You should stand directly in front of the wheel when starting the grinder.

The Radial Arm Saw

30. T F All adjustments should be made with the motor turned off.
31. T F After the material has been cut, it should be removed from the table before the saw has returned to its "home" position.
32. T F The table should be kept clean and free of scrap pieces and excess amounts of sawdust.
33. T F The tendency of the radial arm saw to "climb" towards you is a function of both the width and depth of your dado cut.
34. T F When cross cutting, the wood does not need to be held against the fence.

Jointer

35. T F Stock must be at least 12 inches long to dress edges.
36. T F The guard should always be returned to its proper position after each pass.
37. T F The maximum cut for jointing an edge on a small jointer is 1/8 inch.
38. T F Make adjustments for depth of cut and position of fence before turning on the machine.
39. T F The operator should stand off to the side of the jointer while pushing the wood over the blade.
40. T F Push sticks are never used on the jointer.

The Table Saw

41. T F When helping another student with the operation of the table saw, the helper should pull the stock through the blade.
42. T F Knowing the exact position of the on-off switch can prevent a serious accident in an emergency situation.
43. T F Ripping narrow stock on a table saw can be done if a push stick is used.
44. T F The saw blade should be above the wood being cut so that the bottom of the gullet on the blade is at the top of the wood. An exception might be when cutting plywood, when the blade may stick out as much as one inch.
45. T F The rip fence and miter gauge are often used at the same time.
46. T F Correct procedure is to pull small pieces cut off back towards you between the fence and the rotating blade.
47. T F Anti-kickback fingers are an optional accessory when ripping.
48. T F The saw must be adjusted before it is turned on.
49. T F You can saw wood freehand without using the miter gauge or the rip fence.

Welding

50. T F Do not chip welds without some kind of suitable protection over your eyes.
51. T F It is not safe to arc weld bare handed.
52. T F You need not warn others in the arc welding area before you start to weld, because they will see the light when you begin.
53. T F Cool a hot piece of steel or write "hot" on it when you leave it in the shop, so that others will not come in accidental contact with the hot steel.
54. T F Welding galvanized metal may cause a health problem to you.
55. T F Leather welding gloves are required on both hands when doing oxy-fuel cutting.
56. T F Either chain oxygen and acetylene cylinders securely in an upright position, or weld with the cylinders laying down so they cannot be tipped over.
57. T F Never handle oxyacetylene equipment with oily or greasy hands.
58. T F Never lay a lighted torch down.
59. T F When connecting hoses and equipment to the oxyacetylene welder after changing tanks, it is a good idea to check for leaks.
60. T F Under no condition should a person use matches to light a torch.
61. T F If a cylinder requires a "T" handled wrench to open the valve, be sure to leave the "T" handle wrench in place at all times while welding or cutting.
62. T F If a "flashback" occurs, relight the torch immediately before it cools off.

Farm Power

63. T F Jack stands must always be used to secure a raised piece of equipment before working beneath the raised equipment.
64. T F Overhead hoist capacities must be clearly marked and never exceed.
65. T F Safety pins should always be used to secure hitch pins.
66. T F When using a tractor and a chain to pull a load you should attach the chain to the rear axle of the tractor.
67. T F When driving a tractor up a steep hill the operator should back up perpendicular to the slope.
68. T F The bucket should be positioned low to the ground when driving a loader.
69. T F Implements should be lowered to the ground before dismounting from a tractor.
70. T F All tractors require the use of a seat belt.
71. T F When hooking up a disc to a tractor drawbar you should have a helper hold the tongue of the disc.
72. T F When driving slow moving farm equipment on a public road a SMV sign and flashing lights should be used.
73. T F PTO shafts must be shielded at all times.
74. T F A machine should be completely stopped before removing shields and servicing.
75. T F A tractor may be started while standing on the ground if you are "jump" starting the tractor.

Electricity

76. T F Circuits should always be disconnected before servicing.
77. T F Broken or frayed electrical cords should be replaced before use.
78. T F Electrical equipment should not be used or serviced in wet areas without using OSHA approved insulating boots and gloves.
79. T F The plug grounding prong on modern electrical equipment may be removed since all new equipment is double insulated.
80. T F A 100' 12 gauge extension cord may be safely used with a power tool that draws 15 amps provided the cord is in good condition.

I have completed the Ag Mechanics Safety Exam and understood all items I missed. I have received adequate instruction on the safe and proper use of the machines to be used in the development of the assigned lab projects. I will abide by the safety rules established for the Ag. Mechanics lab, and agree to work in a safe and craftsman-like manner, being totally responsible for my own acts and omissions.

_____
Date

_____
Signature

For each missed question, record the question number and explain the correct answer:

Question Number	Explanation

Portable Power Tools Safety Quiz

1. What should you do if you find a damaged cord on a power tool?

_____

_____

2. What personal protection equipment when using high speed portable tools?

_____

_____

3. What does it mean to say “make sure the path of the tool is clear?”

_____

_____

4. Why is it important to secure the material when using portable power tools?

_____

_____

5. Why do you need to maintain a firm grip on the tool at all times?

_____

_____

6. What should you always check before plugging in any power tool?

_____

_____

7. What should you do when changing blades or bits?

_____

_____

8. Why must you keep the unplugged cord within your sight and control when changing blades or bits?

_____

_____

Portable Drill Safety Quiz

1. What could happen if the stock you are drilling is not secured?

_____

_____

2. What do you need to do before you try to drill a piece of metal?

_____

_____

3. Drill bits must be _____ and _____ in the chuck.
4. Why is long hair a particular hazard when using drills?

_____

_____

5. When is an electric hand drill most likely to 'kick'?

_____

_____

6. What personal protective equipment is required when using an electric hand drill?

_____

_____

Band Saw Safety Quiz

1. How close to the stock should you set the upper guide?

_____

_____

2. What is the minimum distance you should keep your fingers from the blade?

_____

_____

3. How can you tell if you are using too much pressure or twisting the blade excessively?

_____

_____

4. When are 'relief cuts' needed?

_____

_____

5. Why is it dangerous to cut round or odd shaped pieces on the band saw?

_____

_____

6. What personal protective equipment is required when operating a band saw?

_____

_____

7. What should you do if the blade breaks?

_____

_____

8. Why should you stay away from the right hand side of the saw while it is running?

_____

_____

9. Identify three steps for shutting down a band saw?
   (a) _____
   (b) _____
   (c) _____

Jointer Safety Quiz

1. What is the minimum length of stock that should be cut on the jointer?

_____

_____

2. What is the maximum depth of cut that should be used when:
   a) jointing an edge _____
   b) jointing a surface _____
3. Why do you always joint with the grain?

_____

_____

4. Why are bad checks in the wood or loose knots dangerous on the jointer?

_____

_____

5. Why should you never pass your hands directly over the cutter head?

_____

_____

6. When do you have to use a push stick?

_____

_____

7. Is it okay to adjust the height of the outfeed table? Why or why not?

_____

_____

Planer Safety Quiz

1. What is the minimum length of stock that should be cut on the planer?

_____

_____

2. What is the maximum depth of cut that should be made on a planer?

_____

_____

3. What should you do if you need to clear shavings off the table of the planer?

_____

_____

4. What is dangerous about having your fingers or shirt-tail close to the table of the planer?

_____

_____

5. What personal protective equipment should you wear when using a planer?

_____

_____

6. You need to use a backing board if you are planing stock that is less than _____ thick.

_____

_____

7. What should you do if your wood gets stuck in the planer?

_____

_____

Portable Circular Saw Safety

1. Before making a cut with the portable circular saw, you should position the stock so it is

_____

_____

2. What will happen if the ends of the wood you are cutting fall together as you finish a cut with the portable circular saw?

_____

_____

3. What could happen if the blade guard on a portable circular saw is sticking open?

_____

_____

4. Why is it important to keep the line of the cut clear underneath the wood?

_____

_____

5. What will happen if the blade is touching the wood when you pull the trigger to start the saw?

_____

_____

6. Why is it important to keep a firm grip on the saw at all times?

_____

_____

Table Saw Safety Quiz

1. Where should you stand when rip cutting on the table saw?

_____

_____

2. How high should the blade be set above the wood?

_____

_____

3. What is the minimum length of stock that should be cut on the table saw?

_____

_____

4. You must use a push stick if your fingers will come within _____ of the blade.
5. What device should you use to guide the wood when:
   a. rip cutting _____
   b. cross cutting _____
6. Which of the following conditions would produce kickback:
   a) the piece of wood between the blade and the fence, or
   b) the wood outside the blade?
8. Is it okay to reach over the blade?

_____

_____

9. Why is it dangerous to make freehand cuts on the table saw?

_____

_____

10. What three safety devices should always be used when working with a table saw?
    a) _____
    b) _____
    c) _____

Metal Cutoff Saw Safety Quiz

1. What could happen if you try to force the cut while using a metal cut off saw?

_____

_____

2. What will happen if the stock is not tightly clamped in the metal cut off saw before you start your cut?

_____

_____

3. Keep your hands _____at all times.
4. What personal protective equipment is required when operating the metal cut off saw?

_____

_____

5. What makes freshly cut pieces of metal dangerous?

_____

_____

6. If filings build up on the machine, how should you clean them off?

_____

_____

7. Why do you need to keep an eye on the cut as it proceeds?

_____

_____

Bench Grinder Safety Quiz

1. What is the maximum distance allowed between the tool rest and the stone on a grinder?

_____

2. Why is it especially dangerous to grind small pieces on the bench grinder?

_____

_____

3. What could happen if you were to grind on the side of a grinding stone?

_____

_____

4. Where should you stand when starting up the bench grinder?

_____

_____

5. Why should you avoid using excessive pressure when working on the bench grinder?

_____

_____

6. What personal protective equipment do you need when operating a bench grinder?

_____

_____

7. Why is there a danger of burning yourself when using the bench grinder?

_____

_____

8. What kind of materials should not be worked on the bench grinder?

_____

_____

Drill Press Safety Quiz

1. What should you check each time you are about to start the drill press?

_____

_____

2. How do you prevent the bit from slipping off target and possibly breaking when drilling hard materials like metal?

_____

_____

3. Why is it important to secure the material you plan to drill on the drill press?

_____

_____

4. Why do you need to tie long hair back and remove jewelry and/or strings when working around the drill press?

_____

_____

5. What could happen if you move the stock before the bit is completely clear of the hole?

_____

_____

6. How can you avoid making unwanted holes in the drill press vice?

_____

_____

Arc Welding Safety Quiz

1. When arc welding, your clothing must protect you against what three potential hazards?

_____

_____

2. Why is it dangerous to arc weld in wet conditions?

_____

_____

3. Do gas welding goggles or sunglasses provide enough eye protection for arc welding? Why or why not?

_____

_____

4. Clear eye protection must be worn _____.
5. Why is it important to have lots of ventilation when arc welding?

_____

_____

6. In addition to the material you are welding, what else can get hot enough to burn you?

_____

_____

7. Why is it extremely dangerous to weld containers that have held flammable materials?

_____

_____

Oxy-Acetylene Safety Quiz

1. How far should you open the tank valves?
   a) Oxygen _____
   b) Acetylene _____
2. What protective equipment should always be worn when working with oxy-acetylene welding equipment?

_____

_____

3. What is the danger in using grease or oil to lubricate welding fittings?

_____

_____

4. Describe at least two ways of checking for leaks on gas welding equipment.
   a) _____
   b) _____
5. What extra danger exists when welding brass, bronze or galvanized metal?

_____

_____

6. In addition to the material you are welding, what else can get hot enough to burn you?

_____

_____

7. Which of the following is the correct lighting device for an oxy-acetylene torch?
   a) striker
   b) match
   c) cigarette lighter
   d) all of above
8. Why is it extremely dangerous to weld containers that have held flammable materials?

_____

_____

Plasma Cutter Safety Quiz[34]

1. Why should synthetic clothes never be worn when operating the plasma arc cutter?
    a. They are too expensive.
    b. They create an electrical shock hazard.
    c. They are highly flammable.
    d. They are energy absorbing which creates a health hazard.
2. The minimum shaded lens that should be used for plasma arc cutting is ____.
3. The fume plume for plasma arc cutting is _____.
    a. minimal.
    b. about like oxy-fuel gas welding.
    c. large and needs to be ventilated well.
    d. light and dissipates quickly.
4. Which one of the following metals does not give off a toxic fume?
    a. Carbon steel
    b. Beryllium
    c. Copper
    d. Nickel
5. Avoid using the plasma arc cutter in _____.
    a. outside locations.
    b. interior locations.
    c. shops with concrete floors.
    d. area where combustible gases are stored.
6. What combustible gas is generated when aluminum is cut with the plasma arc cutter in the presence of water or moisture?
    a. Propane
    b. Methane
    c. Acetylene
    d. Hydrogen
7. What personal protective equipment should be worn when operating a plasma arc cutter?
_____, _____, _____, _____
8. If plasma arc cutting takes place in the presence of vapors from chlorinated solvents and cleaners what may happen?
    a. A toxic phosgene gas may be generated.
    b. A combustible gas will be formed.
    c. Hydrogen gas may be generated and cause an explosion.
    d. Nothing- there is no danger cutting in this environment.
9. Electrical shock is more of possibility in the plasma arc cutting process than with arc welding process because of _____.
    a. the type of equipment used.
    b. the high voltage and amperage used.
    c. the high arc temperatures.
    d. the plasma gases used in the cutting process.
10. What approximate air pressure must be present to activate most plasma arc cutters? _____

[34] Adapted from Virginia Tech Department of Agricultural, Leadership, and Community Education.. Available at http://www.alce.vt.edu/teacher-resources/lab-safety-resources/plasmsaarcutter.pdf

11. What happen to the travel speed of the plasma arc cutting machine when the metal being cut is thick?
    a. It must be slowed down.
    b. It must be speeded up.
    c. Travel speed does not change.
    d. Travel speed is a function of the operator's ability.
12. How can the plasma arc cutter operator be assured of getting good straight cuts?
    a. Move quickly when making the cut.
    b. Move slowly when making the cut.
    c. Use a straight edge.
d. Increase the amperage slightly to assure complete melting of the edges along the kerf.
13. The constricting nozzle should be held about _____ above the metal being cut when using the plasma arc cutter.
14. Avoid cutting with the plasma arc cutter in _____ locations.
    a. extremely dry
    b. damp or wet
    c. extremely hot
    d. cold
15. Cuts with the plasma arc cutter should be made with the torch moving _____.
    a. Forward.
    b. Backward.
    c. Sideways.
    d. Any of these.
16. If the plasma arc cutter is moved fast in a cut it will _____.
    a. Improve the cut quality.
    b. Reduce dross build up.
    c. Improve time efficiency.
    d. all of these.
17. If the quality of the cut deteriorates with the plasma arc cutter what has most likely happened?
    a. The shield cup needs replacing.
    b. The constricting nozzle needs replacing.
    c. The electrode needs replacing.
    d. Both b and c

Router Safety Quiz

1. Always wear safety glasses and hearing protection.
   T/F
2. _____ should always be disconnected before making any adjustments or changes.
3. The bit should be securely mounted in the _____ and the base should be tight.
4. Ensure stock is free from_____ before starting work.
   a. Nails
   b. Staples
   c. Screws
   d. Foreign objects
   e. All of the above
5. All cords should be kept clear of the cutting area.
   T/F
6. Both hands should always be used on the router.
   T/F
7. When routing around outside edges the router should be guided counter clockwise around the work.
   T/F
8. If the wood is hard use two or more passes to prevent wood from burning or kickback.
   T/F
9. Always test depth of cuts on a piece of _____ lumber.

Foot Shear Safety Quiz

1. The shear must be operated by:
   (a) several students at once;
   (b) an advanced student and the shop foreman;
   (c) one student and a helper; or
   (d) only one person at a time.
2. You should make sure that the foot that is not being used to operate the foot treadle of the shear is kept:
   (a) on the treadle;
   (b) under the treadle;
   (c) clear of the treadle; or
   (d) away from the floor.
3. When using a shear, you should keep your fingers:
   (a) near the clamp and blade;
   (b) under the clamp and blade;
   (c) away from the clamp and blade; or
   (d) between the clamp and blade.
4. After pushing down on the shear's treadle for a cut, you should allow the treadle to:
   (a) stay down;
   (b) return to its normal position as fast as possible;
   (c) return only part way; or
   (d) return slowly to its normal position.
5. The shear must be operated by only one _____ .
6. You should make sure that the foot that is not being used to operate the foot treadle is clear of the _____.
7. When using the shear, you should keep your fingers away from the clamp and_____.
8. After pushing down on the shear's treadle for a cut, you should _____ allow the treadle to return to its normal position .

Pneumatic Nail Gun Safety Quiz

1. Always wear your _____ glasses when using a pneumatic nail gun.
2. Never pull the trigger unless the tool is against a piece of wood. T/F
3. Disconnect the _____ before clearing a jam.
4. You should always disconnect the gun from the compressor before loading it. T/F
5. Ricochets can occur if a nail hits another nail, a very hard surface or if the tool is at an angle. T/F
6. Sequence mode trigger fires _____ nail before the trigger must be released and repressed.
   (a) One
   (b) Two
   (c) Five

Belt Sander Safety Quiz

1. Safety glasses (Are/Are not) the only protective clothing that you need to wear.
2. You should check belt tracking carefully before starting work. T/F
3. The machine should be _____ before placing it on the workbench.
4. The sander should be started _____ it is on the work.
5. See that the trigger switch is _____ before plugging in the machine.
6. Keep the electrical cord _____ from working area.

Portable Grinder Safety Quiz

1. The sparks caused by grinding or sanding are dangerous. T/F
2. The following PPE is generally required when using this tool:
   (a) Safety glasses
   (b) Face Shield
   (c) Hearing protection
   (d) All of the above
3. You are not required to wear protective clothing while using this tool. T/F
4. Make all adjustments _____ plugging in the tool turning _____ the power.
5. Always allow the tool to come to a complete _____ before setting it down.

Spot Welder Safety Quiz

1. The spot welder should be used in a wet, damp work area. T/F
2. The spot welder should always be left plugged in and the current left on. T/F
3. After welding, the tips of the spot welder are very hot. T/F
4. The metal being spot-welded must be clean and dry. T/F
5. Safety glasses are the only required eye protection. T/F

Circular Saw Safety Quiz

1. Always hold the saw firmly _____ the material.
2. Work can be supported by your lag or foot. T/F
3. The guard should be checked for proper operation _____ using the tool.
4. Fingers should be kept _____ from the blade.
5. Start the saw when in contact with the wood. T/F
6. It is OK to wedge a piece of wood to hold the guard back if it is in the way. T/F

Power Miter Saw Safety Quiz

1. Always hold the work firmly _____ the fence and table.
2. The saw can be stopped by pushing a piece of scrap against the side of the blade. T/F
3. Check the guard sections for proper operation _____ using the machine.
4. Hands should be at least a hands width away from the blade. T/F
5. Always allow the saw to get to operating speed before contacting the wood. T/F

Sample Safety Quiz Answer Keys

Herbicide Safety Quiz Answer Key

1. A
2. T
3. T
4. F
5. F

Pesticide Safety Quiz Answer Key

1. T
2. T
3. F
4. No
5. D
6. D
7. T
8. Soap and water

Heat Stress Quiz Answer Key

1. Physical condition, weather conditions, environmental conditions, physical demands of work, type of clothes you are wearing.
2. Feeling unwell, headache, or nausea. Decreased efficiency, coordination, and alertness. Increased irritability. Light-headedness or dizziness. Fainting. Swelling of hands, feet, and ankles, usually one to two days after first exposures.
3. Remove student from the hot environment to rest in a cool place and drink cool water. If a student has fainted, have them rest with his or her legs and feet elevated. Have the student assessed by the first aid attendant, if available, or by a physician. Keep the student under observation until he or she has fully recovered from the effects of the heat. If there is any doubt about their condition, obtain medical advice.
4. D
5. Water

Skid Steer Loader Quiz Answer Key

1. T
2. F
3. Operator compartment
4. T
5. A
6. T
7. T
8. Lowest
9. T
10. T

Shop Safety Quiz Answer Key

General Safety Rules

1. T
2. F
3. T
4. F
5. T
6. T
7. T
8. F
9. F
10. T
11. T
12. T
13. T
14. F
15. T
16. F
17. F
18. F
19. F

The Drill Press

20. T
21. T
22. T
23. F
24. F

The Grinder

25. T
26. F
27. F
28. F
29. F

The Radial Arm Saw

30. T
31. T
32. T
33. F
34. F

Jointer

35. F
36. T
37. F
38. T
39. T
40. F

The Table Saw

41. F
42. T
43. T
44. F
45. F
46. F
47. F
48. T
49. F

Welding

50. T
51. T
52. F
53. T
54. T
55. T
56. F
57. T
58. T
59. T
60. T
61. T

62. F

Farm Power

63. T
64. T
65. T
66. F
67. T
68. T
69. T
70. T
71. F
72. T
73. T
74. T
75. T

Electricity

76. T
77. T
78. T
79. F
80. F

Portable Power Tools Safety Quiz Answer Key

1. Notify the instructor. Do not use the tool.
2. Eye protection, hearing protection, proper protective clothing.
3. Ensure that there is no foreign object in the material being worked on that will block the path of the tool.
4. To ensure there is no kickback and so both hands can be used on the tool.
5. To ensure there is no kickback from the tool. Also, the tool does not get away from the user.
6. That the tool is off and the cord is not damaged.
7. Turn the tool off, wait for it to stop moving on its own, then unplug it before making any adjustments.
8. To ensure no one plugs it in while you are working on it.

Portable Drill Safety Quiz Answer Key

1. The stock could kickback.
2. Mark hole with center hole punch.
3. Insert and tight
4. It can get caught in the drill.
5. When it is not being used properly.
6. Eye protection, hearing protection, protective clothing.

Band Saw Safety Quiz Answer Key

1. It should just clear the piece that is being worked on.
2. 2 inches is the minimum.
3. It will kickback. It can also cause heat to build up.
4. When cutting long or tight curves.
5. Because it cannot be pushed against the guide.
6. Safety glasses, hearing protection, protective clothing.
7. It should be stopped immediately and replaced.
8. It is easier to watch from that side.
   (a) Turn off power. (b) Wait for the blade to stop naturally. (c) Clear material from throat of band saw

Jointer Safety Quiz Answer Key

1. 18 inches
   (a) 1/8 inch (b) 1/16 inch
2. The wood can chip or tear if it is not done with the grain.
3. It can cause the wood to kickback.
4. It could cut you.
5. Always
6. It is okay but only if you can confidently adjust it to the correct height to the jointer.

Planer Safety Quiz Answer Key

1. 15 inches
2. 1/8 inch per pass
3. Turn off the equipment, then unplug it, making sure no one else can plug it in while you are clearing it.
4. They can get sucked into the planer.
5. Eye protection, hearing protection, protective clothing.
6. 3/8 inch
7. Turn the planer off immediately.

Portable Circular Saw Safety Answer Key

1. Supported on both sides.
2. It can pinch the blade causing kickback.
3. You could cut yourself.
4. It reduces the chance of kickback, etc.
5. It can cause the wood to kickback. It can also cause the circular saw to kickback.
6. To avoid losing control of the saw.

Router Safety Quiz Answer Key

1. T
2. Power supply
3. Chuck
4. E
5. T
6. T
7. T
8. T
9. Scrap

Pneumatic Nail Gun Safety Quiz Answer Key

1. Safety
2. T
3. Air hose
4. T
5. T
6. A

Table Saw Safety Quiz Answer Key

1. To the side, NOT behind the blade.
2. 1/8-1/4 inch above the wood.
3. 12 inches
4. 3 inches
5. (a) miter gauge/rip fence (b) miter gauge
6. B
7. No, never
8. The wood can kickback.
9. (a) Spreader/splitter (b) anti-kickback pawls/fingers (c) miter gauge/rip fence

Metal Cutoff Saw Safety Quiz Answer Key

1. It could overload the machine or damage the blade.
2. The blade will “grab” the material and roll it.
3. Are clear of the blade path
4. Eye and hearing protection.
5. They can be sharp and hot.
6. Use a brush.
7. The blade could twist or jam, stock could come loose, or saw could fail to stop when it should.

Bench Grinder Safety Quiz Answer Key

1. 1/16 to 1/8 inch
2. Kickback can happen, etc.
3. It could cause the stone to shatter.
4. To the side.
5. It can cause kickback and can cause the wheel to crack.
6. Safety glasses or face shield.
7. Metal becomes hot as it is ground down.
8. Wood, plastic, or other non-metal materials.

Drill Press Safety Quiz Answer Key

1. Belt guards are installed and working properly. Chuck is tightly secured to spindle.
2. Use the correct speed, correct speed rated bits, secure the material, center punch hole before drilling.
3. So it does not spin causing injury.
4. They can get caught in the bit.
5. The bit could break.
6. Put a piece of scrap lumber under the work piece.

Arc Welding Safety Quiz Answer Key

1. Radiation, hot slag/sparks, chemical burns, fire resistant.
2. It can create a shock hazard.
3. No, because it does not protect against ultraviolet radiation (UV).
4. All the time.
5. The process produces inter-gas.
6. Nozzle, flames, liquid gases.
7. Flammable residue may still be present and can create a potential fire hazard.

Oxy-Acetylene Safety Quiz Answer Key

1. (a) completely (b) 1 turn or less
2. Welding goggles, hearing protection, protective clothing.
3. It can catch on fire.
4. (a) use soapy water applied to equipment (b) special leak detection solution
5. Acetylene gas forms explosive compounds with brass, bronze and copper.
6. Nozzle tip and valve handles.
7. A
8. They may still have flammable material residue in them.

Plasma Cutter Safety Quiz Answer Key

1. C
2. B
3. C
4. A
5. D
6. D
7. Shaded lens, hearing protection, gloves, and leather apron
8. A
9. B
10. 70 psi
11. A
12. C
13. ¼ inch
14. B
15. D
16. D
17. D

Foot Shear Quiz Answer Key

1. (d)
2. (c)
3. (c)
4. (d)
5. person (student)
6. treadle
7. blade
8. slowly

Belt Sander Quiz Answer Key

1. Are Not (dust mask)
2. T
3. at a complete stop
4. before
5. off
7. away

Portable Grinder Written Test Key

1. T
2. d
3. F
4. before, on
5. stop

Spot Welder Safety Quiz Key

1. F
2. F
3. T
4. T
5. F

Circular Saw Safety Quiz Key

1. Against
2. F
3. Before
4. Away
5. F
6. F

Power Miter Saw Safety Quiz Key

1. Against
2. F
3. Before
4. T
5. T

Additional Resources

The references below are useful sources of additional safety information. Many of these resources have materials suitable for use in the classroom that can be ordered or downloaded at no cost.

Hand Tool Safety Institute
http://www.hti.org/

Power Tool Institute
http://www.powertoolinstitute.com/

National Agricultural Safety Database
http://www.nasdonline.org

AWS Safety and Health Fact Sheets
http://www.aws.org/technical/facts/

Outdoor Power Equipment Institute
http://www.opei.org/

Ohio Online (The Ohio State University) Tailgate Topics
http://agsafety.osu.edu/programs/cfaes-osha/tailgate-safety-traininig-employees

Ben Meadows Company (see safety topics)
http://www.benmeadows.com/refinfo/techfacts/default.htm

California Department of Pesticide Regulation (fact Sheets)
http://www.cdpr.ca.gov/docs/dept/factshts/directory.htm

Safety In Agriculture for Youth (SAY)
http://extension.psu.edu/business/ag-safety/news/2015/safety-in-agriculture-for-youth-say-national-clearinghouse