

Safety Manual

December 2010

PURPOSE:

To provide policies, organization, and appropriate administrative practices for the protection of life and health, for the students, employees and visitors at Amarillo College.

To assure compliance with the Requirements for Safety and Security as stated in Section VI of the Criteria for Accreditation promulgated by the Southern Association of Colleges and Schools.

To assure compliance with Federal, State and Local legislation, including but not limited to:

- Texas and Federal Solid Waste Disposal Act;
- Texas Radiation Control Act;
- Texas Public Employer Community Right to Know Act;
- Texas Hazard Communication Act;
- The United States Atomic Energy Act;
- The Ordinances and Codes of the Cities of Amarillo, Dumas and Hereford.

Amarillo College though not required to comply with the Occupational Health and Safety Act, has elected to, for the health and safety of its students and employees and in furtherance of its educational mission to voluntarily adopt and comply with OSHA standards and guidance.

SCOPE:

These safety procedures apply to all operations, properties, campuses, faculty, employees and students of Amarillo College at any and all locations, and while traveling on official College Business.

This Safety Manual establishes the minimum standards of safety for the Amarillo College community. Each Division and Department are encouraged to draft and maintain appropriate and necessary Safety Manuals and Safety Procedures specific to their needs, mission, and requirements of accreditation. When drafted, Division and Departmental Safety Manuals and Safety Procedures are Appendices to this Safety Manual. If a conflict exists between a Division or Departmental Safety Manuals and this Safety Manual, the Division or Departmental Safety Manual supersedes this Safety Manual in those areas of conflict.

INTRODUCTION:

The Amarillo College Emergency Manager, Occupational Safety Environmental Officer (Emergency Manager) is responsible for advising College officials on required safety and health and also for working with College Division and Department Heads in the development of division and departmental safety programs. The overall objective is to maximize the safety and health of employees, students and visitors at Amarillo College.

Programs and services provided by the Emergency Manager include the following:

- Monitor safety regulations;
- Develop policies and/or protocols concerning safety and health issues;
- Disseminate information concerning safety regulations, policies, and Protocols;
- Submit reports and other required documentation to pertinent State Agencies;
- Evaluate the physical infrastructure to maintain safe work, classroom and laboratory environments;
- Report results of evaluations, tests, etc, along with recommended corrective measures to appropriate personnel for action;
- Evaluate injury reports for accident trends and perform investigations as Appropriate;
- Assist with emergency preparedness planning for major disasters and coordinate College plans with the local community;
- Assist departments in the development of Emergency Evacuation Plans;
- Participate in safety committees and task forces;
- Maintain a library of safety audiovisual programs and relevant safety regulations and nationally recognized codes and standards;
- Dispose of hazardous chemical waste;
- Maintain an intermediate storage facility for hazardous chemicals and materials.

Safety programs and services provided by the Physical Plant include:

- Inspect/test safety equipment such as fire extinguishers and fume hoods;
- Review construction plans for compliance with codes and standards;
- Assist departments in planning ADA compliance;
- Assist in emergencies such as fires or chemical spills;
- Measure environmental parameters such as vapors or noise;
- Provide fire safety training relating to fire alarm systems;
- Maintain Material Safety Data Sheets (MSDS) as an information resource on hazardous materials;

Responsibilities of All college employees, students and visitors are:

- Personally responsible and accountable for their own safety and environmental protection as described in this Safety Manual, Division and Departmental Safety Manual and Procedures and the instructions of their supervisors and instructors.

Amarillo College Administration is responsible for the following:

- Providing the physical facilities and equipment required for a safe work environment;
- Reviewing and approving health and safety policies and protocols;
- Correcting safety deficiencies by establishing priorities and committing resources, as appropriate;
- Establishing methods for disseminating safety information and policies;
- Establishing criteria for implementing safety policies and protocols;
- Establishing a system for safety accountability.

Supervisors, Department Chairs and Division Heads are responsible for the following:

- Promoting safety and loss prevention;
- Controlling or eliminating occupational hazards;
- Periodically conducting safety and loss control evaluations;
- Ensuring that employees, students and visitors are adequately trained in safety policies and protocols;
- Ensuring that employees, students and visitors are provided with appropriate personal protective clothing and equipment for safe job performance and learning environment based on the Hazard Communication Act.

Faculty, Staff, and Students are responsible for the following:

- Performing their jobs in the safest prescribed manner;
- Eliminating and/or reporting workplace, classroom and laboratory hazards;
- Reporting accidents, incidents, and unsafe practices or conditions to supervisors and instructors;
- Complying with all safety and health policies and protocols.

Amarillo College Safety Manual:

The Amarillo College Safety Manual has been developed by the Amarillo College Emergency Manager as a reference manual. It describes programs, practices, and procedures to be followed to help ensure a safe and healthy environment. The Safety Manual provides additional guidance to supervisors, employees and, students in performing their duties and responsibilities assigned by the Policies of the College.

It is the intent of the College to comply with all relevant occupational and environmental regulations and nationally recognized codes and standards. Using the manual's protocols will compliment responsible efforts to foster safe work habits and to maintain safe work environments.

In developing the Safety Manual, Amarillo College looked to other institutions of higher education safety manuals for form and content. We wish to recognize the contributions of the University of Texas at Austin, Texas Tech, University of North Texas, and the University of Houston, which provided manuals for consideration.

Throughout the manual you will be referred to contact the College department tasked with the responsibility to address a specific incident or potential hazard. In any case concerned persons can also contact the Emergency Manager for information or support in correcting a hazard or following procedures.

The following sections provide general safety guidelines and procedures on the following topics:

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Chapter 1 General Safety

I. General Safety:

A. Accident Reporting:

An accident is an unplanned occurrence that may result in damage to people, property, equipment, or the environment. When accidents are reported promptly, injured employees, students, and visitors receive timely medical care and unsafe conditions receive prompt corrective action. The Emergency Manager and College Police investigate accidents to identify accident trends, determine the effectiveness of current safety programs, and prevent future accidents.

!IMPORTANT!

Report all accidents to your supervisor, Emergency Manager, or College Police, as appropriate. If an injury or exposure occurs on-the-job, the injured employee's supervisor must complete the First Report of Injury or Illness.

College Police are the focal point for operational emergency communication at Amarillo College. College Police should be called for all emergency situations occurring at Amarillo College (371-5911). If you call 911 Do Not Assume College Police have been or will be notified. Please call College Police for all emergencies occurring at Amarillo College (371-5911). If you call 911 first please call College Police immediately thereafter (371-5911).

EXAMPLE:

- HAZARDS: Report hazards, such as missing manhole covers or chemical spills, to Physical Plant (345-5560). Report accidents such as vehicle collisions to College Police (371-5163 non-emergency, 371-5911 emergency).

Report unsafe conditions or potentially hazardous situations to Physical Plant (345-5560) or the Emergency Manager (345-5542) as quickly as possible. They will then contact other departments and outside agencies as appropriate.

B. Americans with Disabilities Act:

Amarillo College complies with the requirements and guidelines of the Americans with Disabilities Act (ADA). This means that new facilities and renovations to existing facilities are designed to provide accessibility for persons with a disability.

Parking spaces for the disabled and wheelchair ramps must remain accessible at all times. Do not block these areas or tamper with other accessibility equipment. In addition, do not remove Braille tabs on elevator buttons or other signs.

Report accessibility violations such as blocked wheelchair ramps and blocked handicapped parking to the Department of Disability Services, Physical Plant, College Police or the Emergency Manager.

Contact the Department of Disability Services (DOS, 371-5436), for more information on accommodating individuals with a disability or making your workplace more accessible.

Contact the Emergency Manager (345-5542) for additional assistance.

C. Asbestos:

Asbestos is a mineral fiber that causes cancer and various respiratory illnesses. Older buildings constructed prior to 1980 may contain asbestos. Asbestos is commonly found in older appliances, insulation, shingles, siding, putties, and caulking. Generally, it is not a problem unless the material that contains it crumbles or flakes.

The Texas Asbestos Health Protection Rules do not require building owners to conduct inspections and identify all asbestos locations. Inspections are required, however, prior to renovation or dismantling activities.

NOTE:

Call the Physical Plant at 345-5560 before performing work on campus that will disturb building fixtures, walls, or ceiling (e.g., installing, moving or needed repairs to computer cables in the ceiling, call the Information Technology Services, 371-5100). Physical Plant and Information Technology Services will help ensure that the work does not affect asbestos containing materials.

!WARNING!

Do not handle asbestos or suspected asbestos or try to remove it yourself.

Amarillo College has an ongoing Asbestos Management Program that strives to eliminate the potential hazards associated with asbestos. A copy of the Amarillo College Asbestos Management Program is available from the Physical Plant. Physical Plant handles contracts for consultation and/or abatement. Direct any questions about identifying or removing asbestos to the Physical plant (345-5560). Address any safety-related questions to the Physical Plant or the Emergency Manager (345-5542).

D. Dress Code:

Dress in a manner that does not impair safety. Loose clothing, long hair, dangle jewelry, and sandals may be dangerous around moving equipment. Always wear clothing that is appropriate for your job. Refer to the chapters on Personal Protective Equipment for more information.

E. Graphics Arts Media:

The art supplies and chemicals associated with graphic media are often extremely hazardous. Depending on the type of art supplies used, artists can develop the same types of occupational diseases as industrial workers. Studies show that people who work with hazardous graphic media chemicals can develop dermatitis, lead poisoning, silicosis, liver and kidney damage, nerve damage, reproductive problems, carbon monoxide poisoning, cancer, and other ailments.

The risk of chemical hazards is directly linked to the following factors:

- Duration and frequency of exposure
- Chemical toxicity
- Chemical amount

Workers are exposed to graphic media hazards through skin contact, inhalation, and ingestion.

Follow these safety guidelines for working with graphic media materials prior to use of a hazardous material:

- Be fully knowledgeable of the material – training under the Hazard Communication Act (HCA) is mandatory.
- Wear protective clothing and follow MSDS, as appropriate.
- Use nontoxic or less toxic solvents and chemicals when possible.
- Eliminate toxic metals such as lead and cadmium. Instead, use cadmium-free silver solders and lead-free paint, glazes and enamels.
- Use water-based instead of solvent-based materials.
- Use liquid materials to replace powders.
- Use wet techniques (such as wet sanding) instead of dry techniques.

- Apply coatings by brushing or dipping instead of spraying.
- Eliminate cancer-causing chemicals.

1. Solvents:

Solvents are used to dissolve oils, resins, varnishes, and inks. They are also used to remove paint and lacquer. Due to their common usage, solvents are one of the most underrated media hazards. Most organic solvents are poisonous if swallowed or inhaled in sufficient quantities. They also cause dermatitis and narcosis.

Use the least toxic solvent possible. Denatured or isopropyl alcohol, acetone, and odorless mineral spirits are less toxic than solvents such as chloroform or ethylene.

2. Aerosol Sprays:

Aerosol sprays, such as fixatives, paint sprays, and adhesive sprays, are extremely dangerous if someone inhales the fine mists produced by these products. Air brushes and spray guns are equally hazardous. Use aerosol sprays in a well-ventilated area and wear a dust/vapor mask to protect you from the hazardous vapors.

3. Acids and Alkalis:

The acids and alkalis used in ceramics, photo chemicals, paint removers, and similar materials can be very caustic to the skin, eyes, respiratory system, and gastrointestinal system. Likewise the acids and alkalis used to etch metals and glass can be very dangerous. Strong acids, such as hydrochloric, sulfuric, and perchloric acid, require special handling as outlined in the MSDS. Alkalis, such as caustic potash, caustic soda, quicklime, and unslaked lime, also require special treatment. Remember to add acid to water, not water to acid, when mixing chemicals.

4. Paints and Pigments:

Many paints and color pigments contain hazardous chemical compounds. Lead paint, for example, is extremely dangerous, and should never be used in its powder form. Other paint components, such as chromate, cadmium, and cobalt pigments, are equally hazardous. Do not inhale powdered paint or spray paint vapors or accidentally ingest pigment by placing the brush tip in your mouth. In addition, do not eat, drink, or smoke while painting. Any of these activities could result in chronic poisoning.

The table below outlines common paint pigments and their hazardous chemical component:

Hazardous Chemicals:	Pigment (Paint Name):
Arsenic	Emerald Green, Cobalt Violet
Antimony	True Naples Yellow

Cadmium	All Cadmium Pigments
Chromium	Zinc Yellow, Strontium Yellow, Chrome Yellow
Cobalt	Cobalt Violet, Cobalt Green, Cobalt Yellow, Cerulean Blue
Lead	Falk White, Lead White, Creminitz White, Mixed White
Manganese	Manganese Blue, Manganese Violet, Burnt Umber, Raw Umber, Mars Brown
Mercury	Vermilion, Cadmium Vermilion Red

5. Photography:

Many of the chemicals used for photographic processing can cause severe skin and lung problems. The greatest hazards associated with photography include the preparation and use of concentrated chemical solutions. Never touch chemical powders or solutions with unprotected hands. In addition, take care not to stir up and inhale chemical dusts.

!WARNING!

Good ventilation is essential when working with photographic chemicals.

The following are common photographic agents and their hazards:

- Developer: May cause skin irritation and allergic reactions.
- Stop-bath: May cause burns and throat irritation.
- Fixer: Highly irritating to lungs.
- Intensifier: Very corrosive and may cause lung cancer.
- Reducer: Contact with heat, concentrated acids, or ultraviolet radiation produces poisonous gas.
- Toners: Highly toxic.
- Hardeners and stabilizers: Often contain formaldehyde which is poisonous, a skin irritant, and a known carcinogen.

6. Plastics, Acrylics, Epoxy Resins:

Plastic hazards result from making plastic and working with finished plastic. The greatest hazards associated with making plastic come from the monomers, solvents, fillers, catalysts, and hardeners that are commonly toxic. The hazards involved with finished plastics result mainly from the methods used to work the plastic. For example, overheating or burning plastic produces toxic gases. Polishing, sanding, and sawing plastic produces harmful dusts.

Certain types of plastics, such as acrylics and epoxy resins are also hazardous. The components in acrylic, for example, include irritants, explosives, and flammables. The main

hazard associated with acrylic compounds, however, is inhalation. Always maintain good ventilation when working with acrylic.

The epoxy resins used in laminating, casting, glues, and lacquer coatings, are also skin irritants, sensitizers, and suspected cancer-causing agents. Avoid skin contact and inhalation when working with epoxy resins.

7. Pottery and Ceramics:

Pottery clay contains silicates that can be hazardous if inhaled. Many low-fire clays and slip-casting clays also contain talc, which may be contaminated with asbestos. Long-term inhalation of asbestos can cause cancer and respiratory diseases. When mixing clay dust or breaking up dry grog, use exhaust ventilation and/or wear a toxic dust respirator. Work with wet clay when possible.

Pottery glazes also contain free silica, including flint, feldspar, and talc. Wear a toxic dust respirator when mixing or spraying glazes.

Toxic fumes and gases are often produced during the firing process. Ensure that all kilns are ventilated. In addition, use infrared goggles or a shield to look in the kiln peep hole. Proper eye protection will help prevent cataracts.

8. Wood Working:

The hazards associated with woodworking include sawdust inhalation, exposure to toxic solvents and adhesives, and excessive noise from woodworking tools. Long-term inhalation of sawdust can cause chronic respiratory diseases. Depending on the type of wood, short-term sawdust inhalation may also produce allergic reactions. Toxic preservatives, such as arsenic compounds and creosote, may cause cancer and reproductive problems. Epoxy resins and solvent-based adhesives, also pose potential hazards. Use dust collectors around woodworking machines, ensure proper ventilation, and wear personal protective equipment, as appropriate.

F. Hearing Conservation Program:

Excessive noise levels may permanently or temporarily damage a person's hearing. Whenever possible, employees should reduce noise levels to an acceptable level. The following table outlines OSHA limits for acceptable noise exposure indicated as decibels (dB).

Sound Level (dB)	Duration/Day (Hours)
90	8
92	6
95	4
97	3

100	2
102	1 ½
105	1
110	½
115	¼ or less


Hearing loss can be permanent – wear protective equipment when noise levels are high.

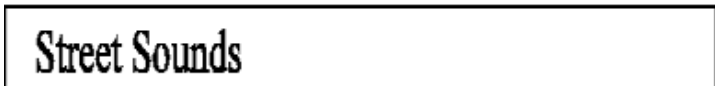
Before using personal protective equipment, such as ear plugs or muffs, to reduce noise exposure, try to reduce noise levels by changing work procedures. Maintenance practices, such as the following can reduce noise levels:

- Replacing worn or loose machine parts;
- Performing high noise operations during hours when people are less likely to be affected;
- maintaining and lubricating equipment to eliminate rattles and squeaks.


The following figure illustrates various noise levels:


 Whisper 10 dB

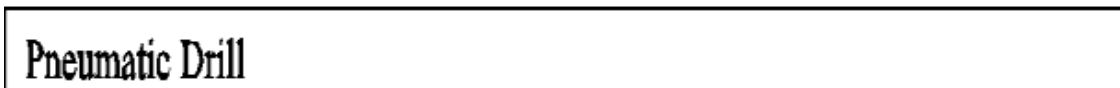
 Quiet Office 30 dB

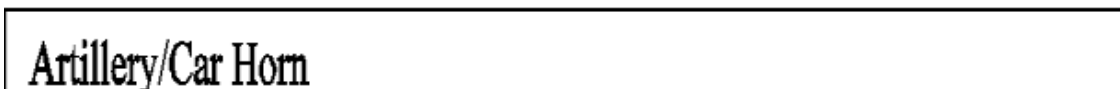
 Street Sounds 70 dB

 Factory 80-90 dB

 Sander 85 dB

 Subway 90 dB

 Pneumatic Drill 100 dB

 Artillery/Car Horn 120 dB

Engineering controls, such as the following, can also reduce noise levels:

- Replacing noisy materials;
- Using large, low speed fans;
- Considering the noise level of new equipment or processes before purchasing or implementing;
- Placing heavy machines on rubber mountings;
- Using sound-absorbing acoustical tiles or baffles;
- Placing noisy machinery or operations in a separate area or room;
- Enclosing noisy conveyors

Areas that may require hearing protection include:

- machine shops,
- the power plant, etc.

Observe all warning signs and wear hearing protection whenever necessary. Do not interfere with, remove, or modify noise abatement equipment. Keep all equipment properly maintained, and report any malfunctions immediately. Refer to the chapter on Personal Protective Equipment for more information on hearing protection. Direct all questions regarding hearing conservation to the Physical Plant Department – they monitor noise levels.

G. Heat Stress:

People may suffer from heat stress during hot, humid conditions. Because the climate at Amarillo College is conducive to heat stress, people must take preventive measures to reduce their risk. To prevent heat stress, employees should limit strenuous physical activity during the hottest portion of the day, wear a brimmed hat when in the sun, take frequent breaks, and drink plenty of fluids.

Heat stress occurs in two forms: heat exhaustion and heat stroke

1. Heat Exhaustion:

Heat exhaustion is usually caused by strenuous physical activity and hot, humid conditions. Because heat exhaustion is the body's response to insufficient water and salt, it should be treated as quickly as possible.

Signs and symptoms of heat exhaustion include the following:

- Exhaustion and restlessness;
- Headache;
- Dizziness;
- Nausea;
- Cold, clammy, moist skin;
- Pale face;
- Cramps in abdomen and lower limbs;
- Fast, shallow breathing;
- Rapid, weak pulse;
- Falling body temperature;
- Fainting.

Take the following steps to administer first aid for heat exhaustion:

- Have the victim lie down in a cool or shaded place;
- If the victim is conscious, have him/her slowly sip cool water;

- If the victim is unconscious or is conscious but does not improve, seek medical aid as soon as possible;
- If the victim is sweating profusely, have him or her sip cool water that contains one teaspoon of table salt per pint of water.

2. Heat Stroke:

Heat stroke is usually caused by exposure to extreme heat and humidity and/or a feverish illness. Heat stroke occurs when the body can no longer control its temperature by sweating. Heat stroke is extremely dangerous and may be fatal if not treated immediately.

The signs and symptoms of heat stroke include the following:

- Hot, dry skin;
- Headache;
- Dizziness;
- High temperature;
- Strong pulse;
- Noisy breathing.

Unconsciousness:

Immediately take the following steps to administer first aid for heat stroke:

- If possible, move the victim to a cool place,
- Seek medical attention as soon as possible,
- Remove the victim's clothing ,
- If the victim is conscious, place them in a half-sitting position and support the head and shoulders,

If the victim is unconscious:

- Place them on the side with the head facing sideways,
- Fan the victim and sponge the body with cool water.

H. Housekeeping:

Good housekeeping skills are essential for personal safety. Amarillo College employees are responsible for reducing potential hazards and keeping their work areas safe and clutter-free. Good housekeeping guidelines include keeping aisles and stairways free from clutter, cleaning spills, minimizing combustibles in workplace and storage areas, and keeping all exits free from obstructions.

Maintain clear and unobstructed access to emergency equipment, such as fire extinguishers, pull stations, eye wash units, showers, etc.

For more specific information on housekeeping, refer to the section in this manual that corresponds to your workplace (ie, Laboratory Safety, Classroom, Office Safety, Shop, etc).

I. Indoor Air Quality:

Indoor air quality refers to the condition of air within an enclosed workplace. The indoor environment of any building is based on several factors including location, climate, building design, construction techniques, building occupant load, and contaminants.

Four key elements are involved in the development of poor indoor air quality:

- Multiple contaminant sources;
- Poor ventilation systems;
- Pollutant pathways;
- Building usage and occupant load.

Outside sources for indoor air contaminants include pollen, dust, industrial pollutants, vehicle exhaust, and unsanitary debris near outdoor air intake vents. Other outdoor agents, such as underground storage tanks or landfills, may also affect indoor air quality

Indoor contaminants are classified according to these categories:

- Combustion products (eg, smoke);
- Volatile organic compounds (eg, solvents and cleaning agents);
- Respiratory particulates (eg, dust, pollen, and asbestos);
- Respiratory byproducts (eg, carbon dioxide);
- Microbial organisms (eg, mold, mildew, fungi, and bacteria);
- Radionuclides (eg, radon);
- Odors (eg, perfume, smoke, mold, and mildew).

Additional examples of indoor contaminants include dust, dirt or microbial growth in ventilation systems, emissions from office equipment, and fumes or odors from any source. Amarillo College follows recognized guidelines for new building ventilation systems and air quality control; however, employees are also responsible for the quality of their indoor air. Because indoor air often contains a variety of contaminants at levels far below most exposure standards, it is difficult to link specific health problems with known pollutants. Employees must minimize all contaminants to reduce the low-level pollutant mixtures that commonly cause health problems.

The following practices will help ensure optimum indoor air quality:

- Fix leaks and drips (Moisture promotes microbial [ie, mold and mildew] growth);
- Clean mold and mildew growths with a bleach/water mixture to prevent regrowth ;
- Ensure that indoor ventilation filters are changed regularly;
- Keep laboratory doors closed;
- Minimize chemical and aerosol usage. Ventilate your area when chemical or aerosol usage is required (These compounds include paint, cleaning agents, hairspray, perfume, etc);
- Do not block air ducts to control the temperature in your office;
- Avoid smoking in enclosed areas;
- If possible, open windows when it is cool and dry outside.

If you have any questions concerning indoor air quality, please contact the Emergency Manager at 345-5542.

J. Lead Paint:

According to the Centers for Disease Control, lead poisoning is a leading environmental health risk. Lead accumulation in a person's system may lead to fatigue, sudden behavioral change, abdominal pain, anorexia, chronic headaches, joint aches, depression, anemia, impotence, and severe fetal damage in unborn infants.

Buildings that were constructed or painted prior to the early 1980's may contain lead paint. Because common sources of lead exposure include ingestion (lead paint) or inhalation (lead-containing dust). it is important to identify all areas that contain lead paint If lead paint flakes or chips. Lead pain must be encapsulated or removed by qualified persons.

The following locations should also be inspected for lead paint:

- Areas where young children or pregnant women are present;
- Areas with flaking or deteriorating paint;
- Areas that were built or painted prior to the early 1980's (Lead testing is particularly important before beginning renovation on older buildings).

Contact the Physical Plant or Emergency Manager if you have any questions about lead paint hazards.

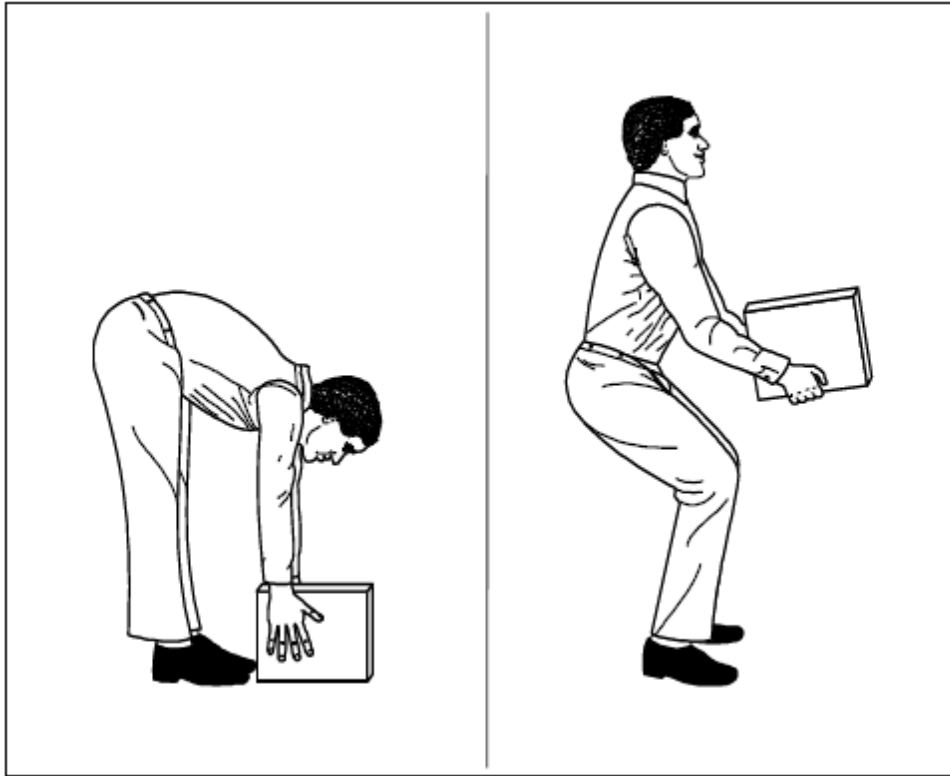
K. Lifting:

All employees must use proper lifting techniques to avoid injury when lifting heavy objects. In general, employees should seek assistance when lifting objects that weigh 50 pounds or more. Use your good judgment to determine if you need assistance, or a dolly, back support belt, or

other tool to safely lift an object. The back supports the weight of the entire upper body. When you lift objects or move heavy loads, your back has to support even more weight. If you exceed your body's natural limits, your back cannot support both your body and the extra load. The excess, unsupported pressure is transferred to the lower back, where injury is imminent. By using the muscles in your arms and legs and exercising proper lifting techniques, you can move loads safely and protect your back from possible injury.

Follow these guidelines to help avoid back injuries:

- Avoid moving objects manually Plan jobs and arrange work areas so that heavy items may be moved mechanically;
- Keep in good physical condition If you are not used to lifting and vigorous exercise, do not attempt difficult lifting tasks;
- Think before you act. Use proper lifting techniques and lifting aides such as back support belts, dollies, etc.;
- Get help if you need it;
- When lifting heavy objects, follow these steps and refer to the illustration on the following page:
 - Test the object's weight before handling it;
 - If it seems too heavy or bulky, get assistance;
 - Face the object, place one foot behind the object and one foot along its side;
 - Bend at the knees;
 - Get a firm, balanced grip on the object Use the palms of your hands, and
 - use gloves if necessary;
 - Keep the object as close to your body as possible (Pull the load in close before lifting);
 - Lift by straightening your legs and slightly unbending your back;
 - If the object is too heavy or bulky, get help;
 - Do not twist the back or bend sideways;
 - Do not perform awkward lifts;
 - Do not lift objects at arm's length;
 - When moving objects, proceed with caution through doors and around corners.



Improper Lifting Proper Lifting

Proper Lifting

L. Polychlorinated Biphenyls (PCBs):

PCBs are found in many oil-based items, electrical fluids, capacitors, light ballasts, and transformers. PCBs are known carcinogens that are toxic to humans through skin exposure, inhalation, and ingestion. PCBs cause skin disorders and they irritate the eyes, ears, nose, and throat. Before shipping, handling, or disposing of oil-based products, Amarillo College employees must determine if their products contain PCBs.

Common trade names for PCBs include the following:

Aroclor and Aroclor B
Abestol
Askarel and Adkarel
Chlorextol
Chlorinol
Clorphen
Diactor
Dykanol
Elemex

Eucarel
Hyvol
Inerteen
No-Flamol
Pyranol
Pyroclor
Saf-T-Kuhl
Sanotherm

Owners are specifically responsible for properly handling any equipment containing PCBs.

For example, PCB transformers must meet the following requirements:

- PCB transformers and owners must be registered with the local Fire Department;
- The PCB transformer and access to the PCB transformer (fences, doors, etc) must be plainly marked with a PCB label;
- Combustible materials may not be stored within five meters of a PCB transformer or enclosure;
- If a transformer is involved in a fire-related incident, the National Response Center must be notified;
- Radial PCB transformers must be equipped with high current fault protection Units with secondary voltage of 480 volts or greater must be equipped with low current fault protection.

The Texas Commission on Environmental Quality considers PCBs to be special waste Class 1 Industrial Waste. Contact the Emergency Manager for disposal procedures.

!IMPORTANT!

Report all PCB leaks (eg, transformer leaks) to the Physical Plant or the Emergency Manager.

M. Preventing Slips and Falls:

It is easy to prevent falling accidents. Employees should always follow good housekeeping practices and pay attention to their environment to avoid slips and falls.

In addition, employees should follow these guidelines:

- Turn on office lights Ensure that passageways are adequately lighted;
- Avoid horseplay;
- Avoid unnecessary haste. Do not run in work areas;
- Use ladders or step-stools to reach high places. Never climb onto a chair, drawer, or shelves;
- Keep hallways and stairwells neat and free of obstacles;
- Remove items that may pose a potential slipping hazard;
- Clean up spills as soon as they occur;
- Never obstruct your view when walking;
- Do not wear clothing that is too long or shoes that have slippery heels or soles;
- Hold the handrail when using stairs;
- Be careful when walking on wet surfaces or when entering a building while wearing wet shoes;

- Report uneven surfaces, such as loose or missing floor tiles, to the Physical Plant for repair.

N. Smoking:

The United States Surgeon General and the Environmental Protection Agency have determined the following:

- Breathing secondary smoke causes various diseases and allergic reactions in healthy non-smokers;
- Separating smokers and non-smokers within the same air space does not eliminate exposure to environmental tobacco smoke for non-smokers;
- Tobacco smoke and secondary tobacco smoke are Class A carcinogens.

To promote a safe, healthy, and pleasant environment for employees, students, and visitors, Amarillo College has instituted a Smoking Policy which can be located at:

<http://www.actx.edu/president/index.php?module=article&id=71>, on the Colleges Website.

O. Visitor Safety:

Employees must take special care to ensure visitor safety. This is particularly important when bringing visitors to potentially hazardous areas such as construction sites or laboratories.

!IMPORTANT!

Office visitors should be escorted; worksite visitors should be escorted, supervised, and monitored. Do not bring children to the workplace.

If a visitor is injured, be sure to report the occurrence to:

College Police – 371-5911, if the injury requires immediate medical attention;
if the injury does not require immediate medical attention – 371-5163;

Emergency Manager – 345-5542;

After attending to the injury.

II. Office Safety:

A. General Office Safety:

A large percentage of workplace accidents and injuries occur in office buildings. Like the shop or laboratory, the office requires a few preventive measures to ensure a safe and healthful environment.

Common causes of office accidents include the following:

- Slipping, tripping, and falling hazards;
- Burning, cutting, and pinching hazards;
- Improper lifting and handling techniques;
- Unobservant and inattentive employees;
- Improper office layout and arrangement;
- Dangerous electrical wiring;
- Exposure to toxic substances;
- Horseplay.

The following sections address several office safety practices. Other preventive measures not mentioned here might be necessary.

Also REMEMBER:

- The office building is not a sterile working environment;
- common workplace hazards can be extra dangerous when you ignore them;
- Refer to other chapters in this manual, such as Electrical Safety, General Safety, Fire Safety, and others for more information on workplace safety;
- Always use common sense when safety is a concern.

B. Good Housekeeping Practices:

Many office accidents are caused by poor housekeeping practices. By keeping the office floor both neat and clean, you can eliminate most slipping, tripping, and falling hazards.

Other good housekeeping practices include the following:

- Ensure that office lighting is adequate and available;
- Replace burned out light bulbs, and have additional lighting installed, as Necessary;
- Ensure that electrical cords and phone cords do not cross walkways or otherwise pose a tripping hazard;
- If you cannot move a cord, have a new outlet installed or secure the cord to the floor with cord covering strips;
- Do not tape cords down or run them underneath carpet;
- Report or repair tripping hazards such as defective tiles, boards, or carpet immediately to the Physical Plant;
- Clean spills and pick up fallen debris immediately;
- Even a loose pencil or paper clip could cause a serious falling injury;
- Keep office equipment, Physical Plant, and machines in good condition;
- Store items in an approved storage space;
- Take care to not stack boxes too high or too tight;
- Ensure that boxes are clearly labeled with their contents.

C. Hazardous Objects and Material:

Hazardous objects such as illegal knives (as defined in Sec. 46.01 (6) and (7), Texas Penal Code) or prohibited knives (as defined in Sec. 46.05 (a) 5, Texas Penal Code) and firearms are not permitted in the workplace. In addition, hazardous chemicals and materials should not be stored in the general office. Hazardous materials include, but are not limited to, the following:

- Carcinogens;
- Combustibles;
- Flammables;
- Gas cylinders;
- Irritants;
- Oxidizers;
- Reactives.

D. Preventing Cuts and Punctures:

Cuts and punctures happen when people use everyday office supplies without exercising care. Follow these guidelines to help reduce the chance for cuts and punctures:

- When sealing envelopes, use a liquid dispenser, not your tongue;
- Be careful when using kitchen knives, scissors, staplers, letter openers, and box openers. Any of these items could cause a painful injury;
- Avoid picking up broken glass with your bare hands. Wear gloves and use a broom and a dustpan;
- Place used blades or broken glass in a rigid container, such as a box, before disposing in a wastebasket.

E. Preventing Machine Accidents:

Only use machines that you know how to operate. Never attempt to operate an unfamiliar machine without reading the machine instructions or receiving directions from a qualified employee.

In addition, follow these guidelines to ensure machine safety:

- Secure machines that tend to move during operation;
- Do not place machines near the edge of a table or desk;
- Ensure that machines with moving parts are guarded to prevent Accidents.
 - Do not remove these guards;
- Unplug defective machines and have them repaired immediately;

- Do not use any machine that smokes, sparks, shocks, or appears defective in any way;
- Close hand-operated paper cutters after each use and activate the Guard;
- Take care when working with copy machines,
 - If you have to open the machine for maintenance, repair, or troubleshooting,
 - remember that some parts may be hot,
 - Always follow the manufacturer's instructions for troubleshooting;
- Unplug paper shredders before conducting maintenance, repair, or Troubleshooting;
- Some items can be very dangerous when worn around machinery with moving parts;
- Avoid wearing the following items around machines within unguarded moving parts:
 - Loose belts,
 - Jewelry,
 - Long, loose hair,
 - Long, loose sleeves or pants,
 - Scarves,
 - Ties,
 - Name/Identity Badges and Lanyards (they should either be removed or placed under protective clothing while operating machinery, RE: to replace them when finished with operating machinery).

F. Preventing Slips and Falls:

As outlined in the General Safety chapter of this manual, the easiest way to avoid slips and falls is to pay attention to your surroundings and to avoid running or rushing.

To ensure safety for others in the office, however, follow these guidelines:

- Arrange office furnishings in a manner that provides unobstructed areas for movement;
- Keep stairs, steps, flooring, and carpeting well maintained;
- Ensure that glass doors have some type of marking to keep people from walking through them;
- Clearly mark any difference in floor level that could cause an accident;
- Secure throw rugs and mats to prevent slipping hazards;
- Do not place wastebaskets or other objects in walkways.

G. Preventing Stress:

To reduce stress and prevent fatigue, it is important to take mini-breaks (not many breaks) throughout the day. If possible, change tasks at least once every two hours. Stretch your arms, neck, and legs often if you do the same type of work for long periods of time. Rest your eyes often by closing them or looking at something other than the work at hand. For a quick pick-me-up, breathe deeply several times by inhaling through your nose and exhaling through your mouth. In addition, always try to eat your lunch somewhere other than your desk. Other examples of stress-relieving exercises that can be done at your desk include the following:

Head and Neck Stretch:

- Slowly turn your head to the left, and hold it for three seconds;
- Slowly turn your head to the right, and hold it for three seconds;
- Drop your chin gently towards your chest, and then tilt it back as far as you can.
- Repeat these steps five to ten times.

Shoulder Roll:

Roll your shoulders forward and then backward using a circular motion

Upper Back Stretch:

Grasp one arm below the elbow and pull gently towards the other shoulder. Hold this position for five seconds and then repeat with the other arm.

Wrist Wave:

With your arms extended in front of you, raise and lower your hands several times.

Finger Stretch:

Make fists with your hands and hold tight for one second, then spread your fingers wide for five seconds.

H. Equipment Safety:

As mentioned earlier, common office machines, such as the following, require special safety consideration: copiers, microwaves, adding machines, typewriters, and computers. Be sure you know how to operate these machines before using them, and never use one of these machines if you think it is defective.

Other office equipment that requires safety consideration includes furniture such as file cabinets and shelves, desks, and chairs.

1. File Cabinets and Shelves:

Because file cabinets and shelves tend to support heavy loads, treat them with special care. Follow these safety guidelines for file cabinets:

- Secure file cabinets that are not weighted at the bottom
 - Either bolt them to the floor or to the wall;
- Ensure that file cabinet drawers cannot easily be pulled clear of the cabinet;
- Do not block ventilation grates with file cabinets;
- Open only one drawer at a time to keep the cabinet from toppling;
- Close drawers when they are not in use;
- Do not place heavy objects on top of cabinets.
 - Be aware that anything on top of a cabinet may fall off if a drawer is opened suddenly;
- Close drawers slowly using the handle to avoid pinched fingers;
- Keep the bottom drawer full,
 - This will help stabilize the entire cabinet.

In addition, follow these safety guidelines for office shelves:

- Secure shelves by bolting them to the floor or wall;
- Place heavy objects on the bottom shelves,
 - This will keep the entire structure more stable;
- Ensure that there is at least 18 inches between the top shelf items and the ceiling,
 - This space will allow ceiling sprinklers (In those buildings in which sprinklers have been installed) to function properly if a fire occurs;
- Do not block ventilation grates with shelves;
- Never climb on shelves (even lower shelves);
- Only use an OSHA and/or UIL approved ladder.

2. Desks:

Follow these safety guidelines for office desks:

- Keep desks in good condition (ie, free from sharp edges, nails, etc);
- Ensure that desks do not block exits or passageways;
- Ensure that glass-top desks do not have sharp edges;
- Ensure that desks with spring-loaded tables function properly,

- The table should not spring forth with enough force to cause an injury;
- Do not climb on desks,
- Only use an OSHA and/or a UIL approved ladder;
- Keep desk drawers closed when not in use;
- Repair or report any desk damage that could be hazardous.

3. Chairs:

Safety guidelines for office chairs include the following:

- Do not lean back in office chairs, particularly swivel chairs with rollers;
- Do not climb on any office chair;
- Never use a chair as a ladder;
- Make sure that your chair's back support position and seat height, if adjustable, are comfortable;
- Take care when sitting in a chair with rollers,
 - Make sure it does not roll out from under you when you sit down ;
- Repair or report any chair damage that could be hazardous to your supervisor;
- Do not roll chairs over electrical cords.

4. Ladders:

Always use an OSHA or UIL approved ladder or stool to reach any item above your extended arm height. Never use a makeshift device, such as a desktop, file cabinet, bookshelf, or box, as a substitute for a ladder.

Follow these guidelines when using ladders:

- Do not load a ladder above its intended weight capacity;
- Place ladders on slip-free surfaces even if they have slip-resistant feet;
- Secure the ladder if a slip-free surface is not available;
- Avoid placing ladders in walkways;
- Secure a ladder if its location could cause an accident;
- Keep areas around ladders clean and free of debris;
- Do not use a ladder in front of a door unless the door is locked and barricaded;
- Refer to the Shop Safety chapter in this manual for more information on ladder safety.

I. Work Station Arrangement:

With the extensive use of computers and other automated desk devices in the workplace, employees must take special care to ensure proper workstation arrangement. For the purpose of this manual, a workstation consists of the equipment and furniture associated with a typical desk job (ie, desk, chair, and computer components). In recent years, computer screens or Video Display Terminals (VDTs) have received much attention concerning nonionizing radiation levels. Tests prove, however, that VDTs do not emit harmful levels of radiation. Improper workstation arrangement combined with repetitive motion, however, may contribute to visual and musculoskeletal fatigue. Cumulative trauma disorders, such as carpal tunnel syndrome may result from the stress of repetitive motion. Therefore, it is very important to arrange your workstation properly and to take breaks frequently. The following sections offer recommendations for ensuring employee comfort through proper workstation arrangement .

1. Operator's Position:

Your seating position at work is important to your comfort and safety. To reduce the painful effects of repetitive motion, follow these guidelines when working with computers or typewriters:

- Always sit up straight;
- Make sure your chair is adjusted to provide adequate support to your back;
- Place your feet flat on the floor or on a footrest, if provided;
- Lower legs should be approximately vertical, and thighs should be approximately horizontal;
- The majority of your weight should be on the buttocks;
- Ensure that there is at least 1 inch of clearance between the top of your thighs and the bottom of the desk or table;
- Keep your wrists in a natural position,
 - They should not rest on the edge of the desk;
- Keep the front edge of your chair approximately 4 inches behind your knees.

2. Equipment Arrangement:

By properly arranging your equipment, you can also help reduce the harmful effects of repetitive motion.

Follow these guidelines for arranging office equipment:

a) Lighting:

Lighting around computer workstations should illuminate the work area without obscuring the VDT or causing glare.

Position computer screens, draperies, blinds, and pictures to reduce glare during work hours (eg, place the VDT screen at a right angle to the window)

b) VDT Screen:

VDT images should be clear and well defined. Adjust the screen's brightness, contrast and display size to meet your needs. If a screen flickers or jumps, have it repaired or replaced.

Place the VDT 20-28 inches away from your face. The center of the VDT should be approximately 15 to 25 degrees below your line of vision

c) Keyboards:

Position computer keyboards so that the angle between the forearm and upper arm is between 80 and 120 degrees.
Place the keyboard in an area that is accessible and comfortable.

d) Wrist Support:

If provided by your department, use wrist supports made of a padded material. The support should allow you to type without bending your wrists.

e) Document Holders:

If provided by your department use document holders that keep documents at approximately the same height and distance from your face as the VDT screen.

f) Telephones:

Neck tension is a common problem caused by holding the telephone between the head and neck. If provided by your department use a headset or speakerphone if you use the telephone for extended periods of time.

III. Shop Safety:

A. General Shop Safety:

The hazards associated with shop work require special safety considerations. Whether you work in a metal shop, wood shop, automotive shop, glass shop, or electrical shop, the potential hazards for personal injury are numerous. This chapter highlights essential safety information for working in an Amarillo College shop. Refer to other chapters in this manual, including General Safety, Electrical Safety, and Fire/Life Safety, for more information on handling many shop situations.

The following table highlights common shop hazards:

Potential Hazards	Hazard Sources
Physical: <ul style="list-style-type: none">- Compressed air/gases- Flying debris- Noise- Pinching, cutting, amputation- Slipping, tripping- UV radiation	<ul style="list-style-type: none">- Oxygen, acetylene, air grinders, saws, welders- Any power tool- Vises, power tools, hand tools- Wood/metal chips, electrical cords, oil, etc- Welding
Electrical: <ul style="list-style-type: none">- Overload- Fire- Shock	<ul style="list-style-type: none">- Too many cords per outlet- Frayed, damaged cords- Ungrounded tools, equipment
Fire: <ul style="list-style-type: none">- Flammable chemicals- Sparks- Static sparks- Uncontrolled fire	<ul style="list-style-type: none">- Gasoline, degreasers, paint thinners, etc.- Welders, grinders- Ungrounded tools or solvent containers- Lack of appropriate fire extinguishers
Chemical: <ul style="list-style-type: none">- Toxic liquids- Toxic fumes, gases, dusts	<ul style="list-style-type: none">- Cleaning solvents, degreasers, etc.- Welding, motor exhaust, etc.

It is not possible to detail all the risks involved with shop work. However, it is possible to foresee many hazards by carefully planning each job. To prevent accidents, utilize your knowledge, training, and common sense. Evaluate potential sources of injury, and attempt to eliminate any hazards.

B. Personal Protection:

There are several measures you must take to protect yourself from shop hazards. For example, do not wear the following when working around machinery:

- Loose fitting clothing;
- Neckties;
- Jewelry.

If you wear a long sleeved shirt, be sure the sleeves are rolled down and buttoned. Snug fitting clothes and safety shoes are essential safety equipment in the shop. Always wear safety glasses with side shields when working with shop Equipment. Additional protection using goggles or face shields may be necessary for the following types of work:

- Grinding, Chipping, Sandblasting;
- Welding;
- Glass working.

Wear approved hard hats whenever there is a chance of objects falling from above. In addition, wear suitable gloves, preferably leather, when working with the following:

- Scrap metal or wood;
- Sharp-edged stock;
- Unfinished lumber.

Refer to the Personal Protective Equipment chapter in this manual for more information.

C. Job Safety:

Before beginning work in a shop, be sure you are authorized to perform the work to be done and inspect your tools and equipment. If a procedure is potentially hazardous to others in the area, warn fellow workers accordingly. Use warning signs or barriers, as necessary. Notify your supervisor if you notice any unsafe conditions such as the following:

- Defective tools or equipment;
- Improperly guarded machines;
- Oil, gas, or other leaks

Inform other employees if you see an unsafe work practice; however, be careful not to distract a person who is working with power tools

D. Safety Guidelines:

Follow these guidelines for general shop safety:

- Know the hazards associated with your work;
- Be sure you are fully educated on the proper use and operation of any tool before beginning a job;
- Always wear appropriate safety gear and protective clothing;
- Wear nitrile gloves when cleaning with degreasers or ferric chloride;
- Ensure that there is adequate ventilation to prevent exposure from vapors of glues, lacquers, paints and from dust and fumes;

- Maintain good housekeeping standards;
- Keep the work area free from slipping/tripping hazards (oil, cords, debris, etc);
- Clean all spills immediately;
- Remove sawdust, wood chips, and metal chips regularly;
- It is recommended that electrical cords pull down from an overhead pulley rather than lying on the floor;
- Leave tool and equipment guards in place;
- Know where fire extinguishers are located and how to use them;
- Make sure all tools and equipment are properly grounded and that cords are in good condition ;
- Double-insulated tools or those with three-wire cords are essential for safety;
- Use extension cords that are large enough for the load and distance;
- Secure all compressed gas cylinders;
- Never use compressed gas to clean clothing or skin;
- Always use flashback arrestors on cutting/welding torches;
- Take precautions against heat stroke and heat exhaustion;
- Wear infrared safety goggles when appropriate.

Refer any questions regarding shop safety to the Physical Plant, the Emergency Manager or your Supervisor.

E. Hand Tools:

Hand tools are non-powered tools. They include axes, wrenches, hammers, chisels, screw drivers, and other hand-operated mechanisms. Even though hand tool injuries tend to be less severe than power tool injuries, hand tool injuries are more common. Because people take everyday hand tools for granted, they forget to follow simple precautions for safety.

The most common hand tool accidents are caused by the following:

- Failure to use the right tool;
- Failure to use a tool correctly;
- Failure to keep edged tools sharp;
- Failure to replace or repair a defective tool;
- Failure to store tools safely.

!IMPORTANT!

Use the right tool to complete a job safely, quickly, and efficiently.

Follow these guidelines for general hand tool safety:

- Wear safety glasses whenever you hammer or cut, especially when working with surfaces that chip or splinter;

- Do not use a screwdriver as a chisel,
 - The tool can slip and cause a deep puncture wound;
- Do not use a chisel as a screwdriver,
 - The tip of the chisel may break and cause an injury;
- Do not use a knife as a screwdriver,
 - The blade can snap and injure an eye;
- Never carry a screwdriver or chisel in your pocket,
 - If you fall, the tool could cause a serious injury,
 - Instead, use a tool belt holder;
- Replace loose, splintered, or cracked handles,
 - Loose hammer, axe, or maul heads can fly off defective handles;
- Use the proper wrench to tighten or loosen nuts Pliers can chew the corners off a nut;
- When using a chisel, always chip or cut away from yourself.
 - Use a soft-headed hammer or mallet to strike a wooden chisel handle,
 - A metal hammer or mallet may cause the handle to split;
- Do not use a wrench if the jaws are sprung;
- Do not use impact tools, such as chisels, wedges, or drift pins, if their heads are mushroom shaped;
 - The heads may shatter upon impact;
- Direct saw blades, knives, and other tools away from aisle areas and other employees;
- Keep knives and scissors sharp;
 - Dull tools are more dangerous than sharp tools;
- Iron or steel hand tools may cause sparks and be hazardous around flammable substances,
 - Use spark-resistant tools made from brass, plastic, aluminum, or wood when working around flammable hazards.

Improper tool storage is responsible for many shop accidents.
Follow these guidelines to ensure proper tool storage:

- Have a specific place for each tool;
- Do not place unguarded cutting tools in a drawer,
 - Many hand injuries are caused by rummaging through drawers that contain a jumbled assortment of sharp-edged tools;
- Store knives or chisels in their scabbards;
- Hang saws with the blades away from someone's reach;
- Provide sturdy hooks to hang most tools on;
- Rack heavy tools, such as axes and sledges, with the heavy end down.

F. Insulation:

Asbestos, man-made mineral fibers, PVC, and urethane foam can be extreme respiratory hazards. To protect yourself from these and other respiratory hazards, minimize your exposure to particulate matter from insulation, fumes, dusts, and aerosols. Refer to the General Safety chapter for more information on asbestos and respiratory hazards.

G. Ladders:

Ladders can make many tasks easier, but they are also a continual Safety Hazard. Even the best ladder is not safe unless you are trained and proficient in using ladders. Each year, many people suffer serious injuries from accidents involving ladders. Before you use a ladder, take a moment to think about doing it safely. A secure, well made ladder is necessary for safe ladder use. Ladders come in different styles, including step, straight, and extension. They also vary in construction and may consist of wood, aluminum, or fiberglass.

Choose the correct type and size ladder for the job. All ladders sold within the US are rated as follows:

Type IA:	Heavy-duty industrial ladder rated to hold up to 250 pounds
Type II:	Medium-duty commercial ladder rated to hold up to 225 pounds
Type III:	Light-duty household ladder rated to hold up to 200 pounds

Follow these guidelines for safe ladder usage:

- Always inspect a ladder before you climb it Make sure the steps are sturdy and the locking mechanisms are in good working order;
- Carry ladders horizontally with the front end slightly higher than the back end;
- To open a stepladder, make sure the spreader is locked and the pail shelf is in position;
 - To open an extension ladder, brace the bottom end and push the rungs or rails out;
- Place ladders on a solid, level surface to ensure safety:
 - Watch for overhead obstructions and powerlines,
 - To prevent ladders from sinking into soft ground, use a large board under the feet of the ladder,
- Position a straight or extension ladder so that the base of the ladder is one foot away from the vertical support for every four feet of working ladder height (eg, if

you are working with eight feet of ladder, place the base of the ladder two feet from the wall);

- Do not place the top of a ladder against a window or an uneven surface;
- When possible, tie the top of a straight or extension ladder to supports;
- Stake and tie the feet of the ladder;
- An extension ladder used for access to a roof must extend at least 3 feet beyond the support point;
- Use a wooden or plastic ladder if you must work near electrical sources;
- Do not place a ladder in front of a door unless you lock and barricade the door and post a warning sign on the opposite side of the door;
- Use common sense when climbing or working on ladders:
 - Wear shoes with slip-resistant soles and make sure they are dry before climbing;
- Never allow more than one person on a ladder;
- To climb or descend a ladder, face the ladder and firmly grip the rails, not the rungs, with both hands;
- Keep your body between the rails at all times,
 - Do not shift your weight to one side;
- Have someone steady the ladder if it cannot be secured otherwise;
- Do not stand on the top four rungs of an extension ladder or the top two rungs of a step ladder;
- When working on a ladder, keep two feet and one hand on the ladder at all times;
- Do not stand on the bucket shelf of a ladder;
- When working on a ladder, carry small tools on a tool belt;
- Use a rope to raise and lower heavy tools;
- Never leave a raised or open ladder unattended;
- Store ladders away from heat and moisture;
- Destroy damaged or unsafe ladders.

H. Power Tools:

Power tools can be extremely dangerous if they are used improperly. Each year, thousands of people are injured or killed by power tool accidents. Common accidents associated with power tools include abrasions, cuts, lacerations, amputations, burns, electrocution, and broken bones.

These accidents are often caused by the following:

- Touching the cutting, drilling, or grinding components;
- Getting caught in moving parts;
- Suffering electrical shock due to improper grounding, equipment defects, or operator misuse;
- Being struck by particles that normally eject during operation;
- Touching hot tools or work pieces;

- Falling in the work area;
- Being struck by falling tools

When working around power tools, you must wear personal protective equipment and avoid wearing loose clothing or jewelry that could catch in moving machinery.

In addition to general shop guidelines, follow these guidelines for working with power tools:

- Use the correct tool for the job;
- Do not use a tool or attachment for something it was not designed to do;
- Select the correct bit, blade, cutter, or grinder wheel for the material at hand,
 - This precaution will reduce the chance for an accident and improve the quality of your work;
- Keep all guards in place Cover exposed belts, pulleys, gears, and shafts that could cause injury;
- Always operate tools at the correct speed for the job at hand,
 - Working too slowly can cause an accident just as easily as working too fast;
- Watch your work when operating power tools,
 - Stop working if something distracts you;
- Do not rely on strength to perform an operation,
 - The correct tool, blade, and method should not require excessive strength,
 - If undue force is necessary, you may be using the wrong tool or have a dull blade;
- Before clearing jams or blockages on power tools, disconnect from power source,
 - Do not use your hand to clear jams or blockages, use an appropriate tool;
- Never reach over equipment while it is running;
- Never disable or tamper with safety releases or other automatic switches;
- When the chance for operator injury is great, use a push stick to move material through a machine;
- Disconnect power tools before performing maintenance or changing components,
 - Keep a firm grip on portable power tools,
 - These tools tend to get away from operators and can be difficult to control;
- Remove chuck keys or adjusting tools prior to operation;
- Keep bystanders away from moving machinery;
- Do not operate power tools when you are sick, fatigued, or taking strong medication;
- When possible, secure work pieces with a clamp or vise to free the hands and minimize the chance of injury;
- Use a jig for pieces that are unstable or do not lie flat.

I. Machine Guards:

Moving machine parts must be safeguarded to protect operators from serious injury. Belts, gears, shafts, pulleys, fly wheels, chains, and other moving parts must be guarded if there is a chance they could contact an employee.

As mentioned before, the hazards associated with moving machinery can be deadly.

Hazardous areas that must be guarded include the following:

- Point of operation,
 - Area where the machine either cuts, bends, molds, or forms, the material;
- Pinch/nip point,
 - Area where moving machine parts can trap, pinch, or crush body parts (eg, roller feeds, intermeshing gears, etc);
- Sharp edges;
- Stored potential energy.

There are three types of barrier guards that protect people from moving Machinery.

They consist of the following:

- Fixed guards,
 - A fixed guard is a permanent machine part that completely encases potential hazards Fixed guards provide maximum operator protection;
- Interlocked guards',
 - Interlock guards are connected to a machine's power source,
 - If the guard is opened or removed, the machine automatically disengages,
 - Interlocking guards are often preferable because they provide adequate protection to the operator, but they also allow easy machine maintenance.
 - This is ideal for problems such as jams;
- Adjustable guards;
 - Self-adjusting guards change their position to allow materials to pass through the moving components of a power tool,
 - These guards accommodate various types of materials, but they provide less protection to the operator.

!IMPORTANT!

Guards must be in place. If a guard is removed to perform maintenance or repairs, follow lockout/tagout procedures.

Replace the guard after repairs are completed.

Do not disable or move machine guards for any reason.

If you notice that a guard is missing or damaged, contact your supervisor and have the guard replaced or repaired before beginning work.

NOTE:

Hand-held power tools typically have less guarding in place than stationary power tools. Use extreme caution when working with hand-held power tools and always wear a face shield.

J. Safety Guidelines:

In addition to the safety suggestions for general power tool usage, there are specific safety requirements for each type of tool.

The following sections cover safety guidelines for these types of tools:

- Drill press;
- Grinder;
- Jointer and shaper;
- Lathe;
- Nail/air gun;
- Planer;
- Forging machines;
- Sander;
- Saw,
 - Band,
 - Circular,
 - Radial arm,
 - Table.

1. Drill Press Safety:

Follow these safety guidelines when using drill presses:

- Securely fasten work materials to prevent spinning,
 - Never use your hands to secure work materials;
- Use a center punch to score the material before drilling;
- Run the drill at the correct speed,
 - Forcing or feeding too fast can break drill bits;
- Never attempt to loosen the chuck unless the power is off;
- Lower the spindle before removing a chuck;
- Never use a regular auger bit in a drill press;
- Frequently back the drill out of deep cuts to clean and cool the bit.

2. Grinder Safety:

Follow these safety guidelines when working with grinders:

- Ensure that no combustible or flammable materials are nearby that could be ignited by sparks from the grinder wheel;
- Ensure that a guard covers at least 270 degrees of the grinding wheel on bench-mounted machines;
- Place the grinder tool rest 1/8 inch from the wheel and slightly above the center line,
 - Adjust the upper tongue guard to 1/4 inch from the wheel;
- Allow the grinder to reach full speed before stepping into the grinding position,
 - Faulty wheels usually break at the start of an operation;
- Unless otherwise designed, grind on the face of the wheel;
- Use a vise-grip plier or clamp to hold small pieces;
- Slowly move work pieces across the face of wheel in a uniform manner,
 - This will keep the wheel sound;
- Do not grind non-ferrous materials;
- Periodically check grinder wheels for soundness,
 - Suspend the wheel on a string and tap it. If the wheel rings, it is probably sound;
- Replace wheels that are badly worn or cracked;
- Never use a wheel that has been dropped or received a heavy blow, even if there is no apparent damage;
- Before using a new wheel, let it run a few seconds at full speed to make sure it is balanced.

3. Jointer and Shaper Safety:

Follow these safety guidelines when using jointers and shapers:

- Ensure that jointers are equipped with cylindrical cutting heads;
- Use a push stick, as necessary;
- Do not use single cutter knives in shaper heads;
- Ensure that knives are balanced and correctly mounted;
- Adjust cut depth before turning the machine on;
- Do not use the jointer for strips that are less than 1 inch wide.

4. Lathe Safety:

Follow these safety guidelines when working with wood lathes:

- Examine wood for knots and other defects before placing it in the lathe;
- Ensure that glued materials are set before placing them in the lathe;
- Before turning the lathe on, slowly turn rough materials a few times to ensure they will clear the tool rest;
- Keep hands off the chuck rim when the lathe is moving;
- Hold all wood cutting tools firmly with two hands;

- Start all jobs at the lowest speed,
 - Ensure that materials are in a cylindrical form before advancing to higher speeds,
 - Never turn large diameter materials at a high speed;
- Firmly screw faceplate work to the faceplate,
 - Take care to avoid cutting too deep and hitting the screws;
- Do not cut too deep or scrape too long;
- Remove the T rest when sanding or polishing.

Follow these safety guidelines when working with metal lathes:

- Make sure that all gear and belt guards are in place;
- Never leave a chuck wrench in a chuck;
- Keep your hands off chuck rims when a lathe is in operation;
- Do not attempt to screw the chuck onto the lathe spindle with the power on, as it may get cross-threaded and cause injury,
 - Stop the machine, place a board under the chuck, and then screw on by hand;
- Steady rests should be properly adjusted to conform with the material being worked on;
- When filing work in a lathe, always face the head stock and chuck;
- See that tailstock, toolholder, and work are properly clamped before turning on power;
- Never attempt to adjust a tool while the lathe is running;
- Never apply a wrench to revolving work or parts;
- Always use a brush to remove chips; never your hands;
- When possible, use pipe sleeves to cover work protruding from the end of the lathe;
- Before removing your work from the lathe, remove the tool bit.

5. Nail/Air Gun Safety (Pneumatic Fastening Tools):

Nail guns and air guns are powered by compressed air. The main danger associated with pneumatic fastening tools is injury from one of the tool's attachments or fasteners.

Follow these safety guidelines for working with pneumatic tools:

- Ensure that pneumatic tools which shoot nails, rivets, or staples are equipped with a device that keeps fasteners from ejecting unless the muzzle is pressed against a firm surface;
- **Never** point a tool at items you do not want to fasten;
- Keep your finger off the trigger until you are ready to begin work,
 - Most pneumatic tools have a hair-trigger that requires little pressure to activate the gun;

- Treat air hoses with the same care as an electrical cord;
- Do not drive fasteners into hard, brittle surfaces or areas where the fastener may pass through the material and protrude on the other side.

6. Planer Safety:

Follow these safety guidelines for working with planers:

- Examine wood for knots and other defects before placing it in the planer;
- Do not plane against the grain of the wood;
- Let go of the materials as the feeder rolls catch;
- Do not follow the work with your hands;
- Do not run boards that are more than 2 inches shorter than the distance between the infeed and outfeed rolls;
- Use a push stick if a board stops with its end on the infeed table;
- If a board sticks under the cutter head, turn off the machine to keep from burning the cutter knives.

7. Forging Machines:

Once punchers, shears, and benders are activated, it is impossible to stop them until the end of a cycle. Use extreme care when working with these tools.

Inspection and maintenance:

- All forge shop equipment must be maintained in a condition which will insure continued safe operation.

8. Hammers and Presses:

All hammers must be positioned or installed in such a manner that they remain on or are anchored to foundations sufficient to support them according to applicable engineering standards.

a) Hammers:

- Die keys and shims must be made from a grade of material that will not unduly crack or splinter .

b) Presses:

- All manually operated valves and switches must be clearly identified and readily accessible.

c) Power-driven hammers:

- Every steam or air hammer must have a safety cylinder head to act as a cushion if the rod should break or pull out of the ram.

d) Gravity Hammers:

- Air-lift hammers must have a safety cylinder head

e) Forging and trimming presses:

- When dies are being changed or maintenance is being performed on the press, insure the following:
 - The power to the pressure is locked out
 - The flywheel is at rest
 - The ram is blocked with a material of the appropriate strength.

f) Upsetters:

- All upsetters must be installed so that they remain on their supporting foundations.

9. Sander Safety:

Follow these safety guidelines for working with circular and belt sanders:

- Ensure that sanding belts are not too tight or too loose,
 - Never operate a sanding disk if the paper is too loose;
- Use the correct grade of abrasive material;
- Ensure that the distance between a circular sander and the edge of the table is not greater than $\frac{1}{4}$ inch;
- Do not push materials against sanders with excessive force;
- Sand only on the downstroke side of a disk sander;
- Do not hold small pieces by hand Use a jig for pieces that are difficult to hold securely.

10. Saw Safety:

There are numerous types of power saws, such as band saws, circular saws, radial arm saws, saber saws, and table saws. Regardless of the type of saw you use, never reach over the sawline to position or guide materials.

Follow these safety guidelines for working with band saws:

- Set the blade evenly with the proper amount of tension;
- Keep your hands on either side of the cut line,
 - Never reach across the cut line for any reason,
- Do not stand to the right of the band saw;
- Be sure the radius of your cutting area is not too small for the saw blade;
- If you hear a rhythmic click, check the saw blade for cracks.

Follow these safety guidelines for working with circular saws:

- Do not raise the saw any higher than absolutely necessary;
- Fasten a clearance block to the fence when cutting off short pieces;
- Never attempt to clear away scraps with your fingers;
- Do not cut thin tubular materials with a circular saw;
- Ensure that the fence is not in the cut line of the saw;
- Take care when working with warped or twisted lumber.

Follow these guidelines when working with a radial arm saw:

- Push the saw blade against the stop before turning on the power;
- Never place one piece of wood on top of another when using this saw,
 - The top piece may kick over;
- This saw pulls itself into wooden materials,
 - It may be necessary to hold the saw back to prevent it from choking;
- Never leave the saw hanging over the end of the arm.

Follow these guidelines when working with table saws:

- Circular table saws must have a hood over the portion of the saw above the table,
 - The hood must automatically adjust to the thickness of, and remain in contact with, the material being cut;
- Circular table saws must have a spreader aligned with the blade,
 - The spreader must be spaced no more than 1/2 inch behind the largest blade mounted in the saw,
 - Providing a spreader while grooving, dadoing, or rabbeting is not Required;
- Circular table saws used for ripping must have non-kickback fingers or dogs;
- Feed rolls and blades of self-feed circular saws must be protected by a hood or guard to prevent the operator's hand from coming in contact with the in-running rolls.

11. Spray Paint Booths:

When working with paint or painting equipment, it is important to have adequate ventilation and to avoid flames or other sources of ignition. Because most paints, varnishes, and thinners are flammable, spray paint jobs should be conducted in a well-ventilated enclosure such as a spray paint booth. Spray paint booths minimize toxic vapors and flammable fumes while providing adequate ventilation. Always wear personal protective equipment when working with paint. In addition, clean the booths and ventilation ducts frequently to avoid heavy accumulations of paint, dust, and pigment.

12. Welding and Cutting (Hot Work Permit):

Welding and cutting are two forms of hot work that require special safety considerations. Unless they are done in a designated shop area, welding and cutting are strictly prohibited without proper authorization, Hot Work Permit.

Before conducting welding or cutting operations, inspect your equipment for the following:

- Welding leads must be completely insulated and in good condition;
- Cutting tools must be leak-free and equipped with proper fittings, gauges, regulators, and flashback devices;
- Oxygen and acetylene tanks must be secured in a safe place.

In addition, follow these guidelines for most welding and cutting procedures:

- Conduct welding and cutting operations in a designated area free from flammable materials;
- When welding or cutting is necessary in an undesignated or hazardous area, have someone nearby act as a fire attendant ;
- Periodically check welding and cutting areas for combustible atmospheres;
- Take care to prevent sparks from starting a fire;
- Remove unused gas cylinders from the welding and cutting area;
- Keep hoses out of doorways and away from other people,
 - A flattened hose can cause a flashback;
- Mark hot metal with a sign or other warning when welding or cutting operations are complete;

The following table provides an overview of welding and cutting hazards:

Potential Hazard	Hazard Source
Electrocution	Damp working conditions Improper grounding Improper insulation Indirect work connection
Hazardous Atmospheres	Confined space Inadequate ventilation Electrode (manganese, chromium, etc) Base metal coating
Sparks, Fire, Explosion	Flammable materials Containers that have held combustibles
UV Radiation Burns	Gas arc Reflective enclosures Inadequate visor lens Welding curtain not it use
Confined Space	Atmosphere not monitored No safety attendant present
Gas Cylinders	Touching cylinder with electrode Storing cylinders on their side Unsecured cylinders

13. Welding Guidelines:

Proper selection of personal protective equipment is very important when welding; make sure your welding helmet visor is dark enough to provide adequate protection. Wear fireproof apron and gloves. In addition, take care to protect other people from the hazards of welding For example, use a welding curtain to protect other employees from UV radiation.

There are three types of welders:

- AC welders:
 - These welders are used for standard welding procedures AC welders are powered by an electrical cord.

- DC welders:
 - These are portable welders that are commonly used in manholes, DC welders have their own power supply
- Wire-feed welders:
 - These welders use inert gas for light metal work (eg, stainless steel, aluminum, etc).

Common hazards associated with welding include the following:

- Electrocution;
- Burns;
- UV radiation exposure;
- Oxygen depletion;
- Sparking.

In addition to the general guidelines for welding and cutting, follow these specific guidelines for safe welding operations:

- Make sure the welding area has a nonreflective, noncombustible surface;
- Ensure that adequate ventilation and exhaust are available;
- Be aware of electrocution hazards, particularly in damp conditions,
 - Be sure that electrical cords are properly grounded,
 - It is advisable for cords to pull down from an overhead pulley.

14. Cutting Guidelines:

Gas welding and cutting tools are often powered by oxygen or acetylene gas cylinders. These tanks require special safety precautions to prevent explosions and serious injuries. Follow the safety guidelines below, and refer to the Laboratory Safety chapter in this manual for more information on gas cylinder safety:

- Ensure that acetylene/oxygen systems are equipped with flame or flashback arrestors;
- Store acetylene bottles upright and secured. Oxygen cylinders must be stored 20 feet from flammable gases or separated by a fire foot wall;
- Keep cylinder fittings and hoses free from oil and grease;
- Repair or replace defective hoses by splicing,
 - Do not use tape;
- Do not tamper or attempt to repair cylinders, valves, or regulators;
- Do not interchange regulators or pressure gauges with other gas cylinders;
- Carefully purge hoses and torches before connecting a cylinder;

- Set acetylene pressure at or below 15 psig,
 - Always use the minimum acceptable flowrate;
- Never use a match to light a torch,
 - Use an approved lighter.

IV. Electrical Safety:

A. General Electrical Safety:

The danger of injury through electrical shock is possible whenever electrical power is present. When a person's body completes a circuit and thus connects a power source with the ground, an electrical burn or injury is imminent. Most fatal injuries result from high-voltage exposure; however, people can sustain severe injuries from low voltage power if it has a high current flow. Electrical safety is important in every work environment. The following sections cover circuit breaker loads, electrical grounding, electrical safety guidelines, and electrical emergency response.

B. Definitions:

The following definitions help clarify general electrical safety:

1. Amps:

- The standard unit for measuring electrical current.

2. Watt:

- A unit of electrical power, equal to the power developed in a circuit by a current of amp flowing through a potential difference of one volt.

3. Voltage:

- Electromotive force expressed in volts.

4. Circuit Breaker:

- A device that automatically interrupts the flow of an electrical current.

5. Breaker Box:

- An insulated box on which interconnected circuits are mounted.

6. Electrical Panel:

- An insulated panel on which electrical wires are mounted.

7. Current Flow:

- The rate of flow of an electrical charge, generally expressed in amps.

8. Electrical Load:

- The amount of power delivered by a generator or carried by a circuit,
 - A device to which the power is delivered.

9. Ground-Fault Circuit Interrupter (GFCI):

- A GFCI detects grounding problems and shuts electricity off to prevent a possible accident.

10. High Voltage:

- The term high voltage applies to electrical equipment that operates at:
 - more than 600 Volts (for terminal to terminal operation) or,
 - more than 300 Volts (for terminal to ground operation);
- Low voltage, high current AC or DC power supplies are also considered to be high voltage.

11. Hazardous Energy Sources:

- This term applies to stored or residual energy such as that in capacitors, springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, steam, or water pressure.

12. Lockout:

- The placement of a lock on an energy-isolating device,
 - This act prevents workers from operating a piece of equipment until the lock is removed.

13. Tagout:

- The placement of a tag on an energy-isolating device,
 - A tagout device is a prominent warning device of a lockout.

14. Energy-Isolating Device:

- A mechanical device that prevents the transmission or release of Energy,
 - Examples include the following:
 - Manually operated circuit breakers,
 - Disconnect switches,
 - Line or block valves,
 - Pushbuttons, selector switches, and other control circuit devices do not isolate energy,
 - Energy-isolating devices should be lockable by means of a hasp or other type of attachment,
 - It should not be necessary to dismantle or reassemble a device to lock it.

15. Authorized Employee:

- A person who locks out or tags out equipment for service or maintenance;
- Authorized employees have been formally trained in proper lockout/tagout procedures.

C. Circuit Breaker Loads:

Most office and laboratory locations have 20 amp circuit breakers that serve two or more outlets. These breakers can handle most office equipment; however, the widespread use of personal computers and associated hardware can create an electrical overload.

To determine your current electrical load, follow these steps:

- Check office/laboratory equipment for a manufacturer's rating label that indicates total watts or amps;
- Take special care to check appliances that use electricity to generate heat;
- Convert the watts rating to amps:
 - $\text{Amps} = \text{Watts} / 120 \text{ Volts}$
- Total the amps for each circuit,
 - If the total equals more than 15 amps per 20-amp circuit, you may be overloading the circuit,
 - Move enough equipment to a different circuit to reduce the circuit load; otherwise,
 - have Physical Plant inspect the circuit wiring.

D. Electrical Grounding:

Proper electrical grounding can help prevent electrical injury. Most electrical equipment is grounded with either a three-prong plug or a two-prong plug and insulation. Because a grounding system may be defective without your knowledge, use a ground-fault circuit

interrupter (GFCI) to ensure electrical safety. GFCIs are required in moist or potentially damp environments.

E. Electrical Panels:

Electrical panels or breaker boxes require special safety considerations, including the following:

- Know where your panel box is located;
- Do not tape circuit switches to keep a breaker from tripping;
- Ensure that breaker circuits are accurately labeled within panel boxes;
- Ensure that panel box doors are securely attached;
- Do not block panel boxes,
 - There should be at least 30 inches of clear space in front of a panel box;
- Report tripped breakers and refer any electrical questions to the Physical Plant.

F. Electrical Safety Guidelines:

Follow these guidelines for general electrical safety:

- Be familiar with the electrical hazards associated with your workplace;
- Unplug electrical equipment before repairing or servicing it;
- If a prong breaks off inside an outlet, do not attempt to remove it yourself, Call the Physical Plant for assistance;
- Ensure that outlets are firmly mounted Report loose outlets to the Physical Plant;
- Report all electrical problems, including tripped breakers, broken switches, and flickering lights, to the Physical Plant;
- All appliances and electrical equipment used in Amarillo College buildings must be UL or FM (Factory Mutual) labeled;
- Do not use an appliance or equipment that sparks, smokes, or becomes excessively hot, unless the appliance is specifically designed to exhibit these characteristics;
- Portable electrical heaters must be placed to avoid causing a trip hazard and must be kept away from combustible material,
 - Never leave a heater unattended,
 - Unplug the heater at the end of the day,
 - or when not in use;
- Keep electrical equipment away from water, unless the appliance is specifically designed for use around water, such as a wet-dry shop vacuum;
- Use GFCIs whenever possible;
- Be aware of overhead power lines when working with tall equipment (eg, cranes, etc);
- Follow lockout/tagout procedures, as appropriate;

Follow these guidelines for electrical plug and cord safety:

- Do not remove the prongs of an electrical plug,
 - If plug prongs are missing, loose, or bent, replace the entire plug;
- Do not use an adapter or extension cord to defeat a standard grounding device (eg, Only place three-prong plugs in three-prong outlets; do not alter them to fit in a two-prong outlet);
- Use extension cords only when necessary and only on a temporary basis,
 - Do not use extension cords in place of permanent wiring,
- Request new outlets if your work requires equipment in an area without an outlet;
- Use extension cords that are the correct size or rating for the equipment in use,
 - The diameter of the extension cord should be the same or greater than the cord of the equipment in use;
- Do not run electrical cords above ceiling tiles or through walls;
- Keep electrical cords away from areas where they may be pinched and areas where they may pose a tripping or fire hazard (eg, doorways, walkways, under carpet, etc);
- Avoid plugging more than one appliance in each outlet,
 - If multiple appliances are necessary, use an approved power strip with a surge protector and circuit breaker,
 - Do not overload the circuit breaker;
- Discard damaged cords, cords that become hot, or cords with exposed wiring;
- Never unplug an appliance by pulling on the cord; pull on the plug.

G. Electrical Emergency Response:

The following instructions provide guidelines for handling three types of electrical emergencies:

1 Electric Shock:

- When someone suffers serious electrical shock, he or she may be knocked unconscious;
- If the victim is still in contact with the electrical current, immediately turn off the electrical power source;
- If you cannot disconnect the power source,
 - try to separate the victim from the power source with a nonconductive object, such as a wood-handled broom.

!IMPORTANT!

Do not touch a victim that is still in contact with a power source; you could electrocute yourself.

Have someone call for emergency medical assistance immediately.

Administer first aid, as appropriate.

2. Electrical Fire:

- If an electrical fire occurs,
 - try to disconnect the electrical power source, if possible,
 - If the fire is small, you are not in immediate danger,
 - If you have been trained in fighting fires, use any type of fire extinguisher **except water** to extinguish the fire.

!IMPORTANT!

Do not use water on an electrical fire.

H. Power Lines:

Stay away from live power lines and downed power lines. Be particularly careful if a live power line is touching a body of water. The water could conduct electricity.

If a power line falls on your car while you are inside, remain in the vehicle until help arrives.

I. Lockout/Tagout Procedures:

Lockout/tagout procedures are used to isolate hazardous energy sources from electrical, hydraulic, or pneumatic machinery. Furthermore, when service or maintenance work is required, lockout and tagout devices help ensure personal safety from possible energy releases. All employees whose work involves hazardous energy sources must be trained in lockout/tagout procedures.

Before performing service or maintenance work on machines, turn them off and disconnect them from their energy sources. To further ensure employee safety, use lockout and tagout energy-isolating devices.

The following sections provide information on lockout/tagout procedures. In addition to the procedures in this manual, Amarillo College maintains a Lockout/Tagout Program for the Control of Hazardous Energy. A copy of this document is available from the Physical Plant.

1. Applying Lockout/Tag-out Devices:

Only authorized employees may apply lockout/tagout devices. The following steps provide a brief outline of approved application procedures:

- Notify employees that the equipment requires service or maintenance and is scheduled for shutdown and lockout/tagout;

- Use established procedures to identify the type, magnitude, and hazards of the equipment's energy source;
- Make sure you know the proper methods for controlling the energy Source;
- If the equipment is currently operating, shut it down using normal shutdown procedures;
- Isolate the equipment from its energy source by activating the energy-isolating device(s),
 - Either lockout or tagout the energy-isolating device(s);
- Dissipate or restrain stored and residual energy using methods such as:
 - grounding, repositioning, blocking, bleeding, etc (Capacitors, springs, hydraulic systems, and air/gas/water pressure system may contain stored or residual energy);
- Ensure that all employees are removed from the equipment,
 - Then, test the equipment for successful isolation by attempting to operate it.

!IMPORTANT!

After verifying isolation, return the controls to neutral or off.

2. Removing Lockout/Tag-out Devices:

- When service and maintenance are complete, authorized employees may remove lockout/tagout devices and return equipment to normal operations;
- The following steps provide a brief outline of approved removal procedures:
 - Inspect the work area and remove any nonessential items,
 - Make sure the isolation equipment is intact and in good working condition,
 - Ensure that all employees are safely removed from the equipment,
 - Verify that the equipment controls are in neutral or off,
 - Remove the lockout/tagout devices and re-energize the equipment;

NOTE:

The removal of some forms of blocking may require the equipment to be re-energized before safe removal.

- Notify employees that the equipment is ready for operation.

J. High Voltage Procedures:

In addition to the guidelines associated with general electrical safety and lockout/tagout procedures, there are more stringent safety requirements for high voltage procedures. The following list provides high-voltage safety tips For more information, please refer to Title 29 Section 1910269 of the Code of Federal Regulations or NFPA 70 (National Electric Code).

- Ensure that only authorized employees work around high voltage equipment;
- Label entrances with a High Voltage Sign;
- Ensure that terminal voltage ratings can withstand surges caused by electrical faults or switching transients,
- Be careful around output circuits even when the input power is off;
 - Parallel power sources and energy storage devices can still be Dangerous;
- Be careful when working with power supplies that serve more than one area;
- Before working in a high voltage area, inspect the power supply and check all protective devices;
- Do not work alone near high voltage;
- Label equipment to identify power sources,
 - Label input power sources to identify connected power supply loads;
- Attach emergency shutdown instructions and phone numbers to equipment that is remotely controlled or unattended while energized.

Before entering a power supply or associated equipment enclosure to work on hazardous energy sources, complete the following:

- De-energize the equipment;
- Open and lockout the main input power circuit breaker;
- Check for auxiliary power circuits that could still be energized;
- Inspect automatic shorting devices for proper operation ;
- Short the power supply with grounding hooks.

K. Minimum Clear Working Space:

The following table from the National Electric Code provides minimum depth of clear working space in front of electrical equipment:

Nominal Voltage to Ground	Conditions		
	i	ii	iii
	(ft)	(ft)	(ft)
601 – 2,500	3	4	5
2,501 – 9,000	4	5	6
9,001 – 25,000	5	6	9
25,001 – 75kV	6	8	10
Above 75kV	8	10	12

Where conditions (i), (ii), and (iii) are as follows:

- Exposed live parts on one side and no live or grounded parts on the other side of the working space, or exposed live parts on both sides effectively guarded by suitable wood or other insulating materials,
 - Insulated wire or insulated bus bars operating at not over 300 volts shall not be considered live parts;
- Exposed live parts on one side and grounded parts on the other side of Concrete, brick, or tile walls will be considered as grounded surfaces;
- Exposed live parts on both sides of the workspace [not guarded as provided in condition (i)] with the operator between.

V. Construction Safety Guidelines:

Construction work can be particularly hazardous. Personal protective equipment, fire safety, electrical safety, and other precautions are essential for safe construction work. Refer to other chapters in this manual for more information.

Follow these guidelines when visiting or working at construction sites:

- Do not walk, stand, or work under suspended loads If you raise a load, be sure to crib, block, or otherwise secure the load as soon as possible
- Avoid placing unusual strain on equipment or materials;
- Be prepared for unexpected hazards **BE ALERT!**

A. Barriers and Guards:

College employees must use barriers and guards as necessary to protect employees, students, contractors, and visitors from physical hazards. If you suspect a hazard is not sufficiently protected, notify the attending workers, The Physical Plant or the Emergency Manager immediately.

NOTE:

Barriers, guards, and warning signs are required to ensure safety against existing hazards.

1. Types of Barriers and Guards:

Standard types of barriers and guards include the following:

- Guardrails and handholds;
- Saw horses;
- Tape;
- Toe boards;

- Cones;
- Other physical barriers and solid separators (dust barriers, hazard barriers, temporary walkways, etc).

NOTE:

Signs that state DANGER, WARNING, or CAUTION are also important when barriers or guards are necessary.

Remember to make signs legible, visible, and brief.

2. Areas that Need Barriers or Guards:

Any area that poses a physical threat to workers and/or pedestrians requires barriers or guards. Areas that typically require permanent or temporary protection include the following:

- Stairways;
- Hatches;
- Chutes;
- Open Manholes;
- Elevated platforms;
- Areas with moving machinery;
- Excavation sites;
- Construction sites;
- Temporary wall or floor openings.

3. Using Barriers and Guards:

The following list provides guidelines for using barriers and guards:

- When necessary, reroute pedestrian and vehicular traffic to completely avoid a construction site;
- Guard any permanent ground opening into which a person could fall with a guardrail, load-bearing cover, or other physical barrier;
- Ensure that temporary floor openings, such as pits and open manholes, are guarded by secure, removable guardrails,
 - If guardrails are not available, have someone guard the opening;
- Ensure that all stairways, ladder ways, hatchways, or chute floor openings have handrails or hinged covers;
- Ensure that enclosed stairways with four or more steps have at least one railing, and that open stairways with four or more steps have two railings;
- Ensure that all platforms and walkways that are elevated or located next to moving machinery are equipped with handrails, guardrails, or toe boards;
- Barricade any wall openings through which a person or tools could fall,
 - Use gates, doors, guardrails, or other physical barriers to block the opening;

- Mark and guard any excavation that is deeper than 12 inches;
- Mark and/or guard potholes and sidewalk damage as appropriate;
- Protect smoke detectors with some type of cover when construction work, such as dust or fume producing activities, may affect smoke detectors;
- Remove protectors immediately at the end of the activity or at the end of each day.

B. Heavy Equipment Safety:

When using heavy equipment, there are five basic guidelines that employees must always follow to ensure safety:

1. Know how to properly operate the equipment you are using;
2. Do not use heavy machinery when you are drowsy, intoxicated, or taking prescription medication that may affect your performance;
3. Use only equipment that is appropriate for the work to be done;
4. Inspect your equipment to ensure that it is in good working condition before beginning a job,
 - In addition, ensure that regular inspections and maintenance are conducted as appropriate;
5. Do not stress or overload your equipment.

Accidents do not just happen, they are caused.

Therefore, employees should also follow these guidelines:

Ensure the following before leaving equipment unattended:

- All buckets, blades, etc are on the ground;
- Transmission is in neutral;
- Engine is off;
- Equipment is secure against movement;
- Never get on or off moving equipment;
- Do not attempt to lubricate or adjust a running engine;
- Turn the engine off before refueling;
- Keep all shields and safety guards in place;
- Avoid underground utilities and overhead power lines.

The following sections provide basic guidelines for working with forklifts, front-end loaders, and backhoes. Refer to the product documentation that accompanied your equipment for more information and specific instructions.

1. Forklifts:

Only authorized employees may operate forklifts.

The following list provides general safety guidelines:

- Do not allow riders Do not raise people on a forklift;
- Do not speed;
- Drive up and back down ramps;
- Do not walk, stand, or work under the elevated portion of a forklift (even if it is not loaded);
- Ensure that the forklift has an overhead barrier to protect the operator from falling objects.

In addition, follow these guidelines for safe forklift operation:

- Always work within the capacity limits of your forklift;
- Consult with the manufacturer before modifying the operation or capacity limits of a forklift ;
- Do not operate a forklift in areas with hazardous concentrations of acetylene, butadiene, hydrogen, ethylene, or diethyl ether, or other explosive environment;
- Never lift a load while moving,
 - Wait until you are completely stopped before raising the mast;
- Be sure the top load sits squarely on the stack,
 - An uneven load could topple;
- Travel with loads slightly tilted back to provide stability;
- Travel with loads at the proper height,
 - A stable clearance height is usually 4 to 6 inches at the tips and 2 inches at the heels of fork blades;
- Lift stacked loads in the same manner as loads on the floor;
- When preparing to leave the forklift unattended, lower the mast, neutralize the controls, shut the power off, and set the brakes,
 - The forklift is unattended when the operator is more than 25 feet away or the forklift is out of view.
- When ascending or descending a grade in excess of 10 percent, drive the forklift with the load upgrade;
- If you cannot see over a load, drive in reverse,
 - Do not try to look around a load and drive forward.

2. Back Hoes:

Only authorized employees may operate backhoes and front-end loaders.

The following list offers general safety guidelines for both types of machinery:

- Always operate at a safe speed;
- Travel with the bucket low to the ground;
- Always lower the bucket before servicing the equipment or leaving the loader unattended;

- Use a rigid-type coupler when towing loads;
- Always check with the utility company before digging;
- Be extremely careful when operating near banks and slopes;
- When cutting a bank, be careful not to cause a cave-in;
- Do not drive on an overhang.

3. Hoists:

Only authorized employees may use hoists to move heavy objects and equipment. When using hoists, remember to follow the five safety guidelines for working with heavy equipment (Refer to the section on heavy equipment for more information). In addition, follow the guidelines in the following sections:

a) Hoisting Guidelines:

The following are general guidelines for working with hoists:

- Never walk, stand, or work beneath a hoist;
- Isolate hoisting area with barriers, guards, and signs, as appropriate;
- Never exceed the capacity limits of your hoist;
- Wear gloves and other personal protective equipment, as appropriate, when working with hoists and cables;
- Ensure that hoists are inspected regularly;
- Always hold tension on the cable when reeling it in or out;
- When the work is complete, always rig the hoist down and secure it;
- When the load block or hook is at floor level or its lowest point of travel,
 - ensure that at least two turns of rope remain on the drum;
- Be prepared to stop operations immediately if signaled by the safety watch or another person.

b) Picking Up Loads with Hoists:

Ensure that the hoist is directly above a load before picking it up. This keeps the hoist from becoming stressed. Picking up loads at odd angles may result in injury to people or damage to the hoist.

Do not pick up loads by running the cable through, over, or around obstructions. These obstructions can foul the cable or catch on the load and cause an accident.

c) Avoiding Electrical Hazards with Hoists:

Do not hoist loads when any portion of the hoisting equipment or suspended load can come within 6 feet of high-voltage electrical lines or equipment.

If you need to hoist near high-voltage electrical lines or equipment, obtain clearance from your supervisor first

d) Inspecting Hoists:

Hoists should be inspected daily. If there is any question about the working condition of a hoist, do not use it.

Hoist inspectors should note the following:

- The hooks on all blocks, including snatch blocks, must have properly working safety latches;
- All hooks on hoisting equipment should be free of cracks and damage;
- The maximum load capacity for the hoist must be noted on the equipment;
- Cables and wiring should be intact and free of damage.

C. Scaffolding:

When employees must conduct construction work above the ground and away from solid platforms, scaffolds may be appropriate. The following list provides guidelines for using small scaffolds. Larger scaffolds must be designed and erected in accordance with applicable standards.

- Ensure that scaffold anchors are sound, rigid, and capable of supporting the maximum intended load without shifting.

NOTE:

Scaffolds and their components should be capable of supporting at least four times their maximum load.

- For freestanding, mobile scaffolds, the height should not exceed four times the minimum base dimension,
 - If workers are riding the scaffolding, however, the base dimension should be at least one half the height.
- Do not use unstable objects such as barrels, boxes, bricks, or blocks to support scaffolds or planks;
- Keep floors free of debris where mobile scaffolds are used;
- Lock scaffolds with wheels into position;
- Install guardrails, midrails, or toe boards on the open sides and ends of platforms that are more than 4 feet above the ground or floor level,
 - Use lifelines for scaffolds that are more than 10 feet off the ground;
- Either overlap multiple planking and platforms by 12 inches or secure them to ensure stability;

NOTE:

Planks must extend over end supports between 6 and 18 inches.

- Secure scaffolds to permanent structures with anchor bolts or other means;
- Do not load scaffolds in excess of their maximum load limits;
- Repair damaged scaffolds immediately;
- Do not work on scaffolds in high winds or during storms;
- Remove ice or snow from scaffolds and apply sand to the wood before conducting work in winter weather;
- Do not allow tools, equipment, or other debris to accumulate on scaffolds;
- Dismantle and remove scaffolds when they are no longer needed;
- Do not use temporary scaffolding as a permanent installation

VI. Confined Spaces Safety:

A confined space is any enclosed area with the following characteristics:

- Limited means of entry or exit;
- Structure that is not designed for extended human occupation;
- Atmosphere that is actually or potentially hazardous:

Potential for other hazards;

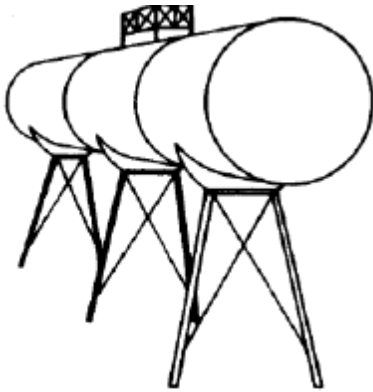
Because confined spaces offer limited means of entry or exit and may contain hazards, employees must comply with 29 CFR 1910.146 and the Amarillo College Confined Space Entry Program when working in these areas. The Confined Space Entry Program is available from the Physical Plant and is attached as an Appendix. Most confined spaces are actually or potentially hazardous. These confined spaces require work permits because they have one or more of the following:

- Hazardous atmosphere or the potential to contain hazardous atmosphere;
- Materials that could engulf workers;
- Internal structure or contents that could trap or asphyxiate employees;
- Other recognizable hazards.

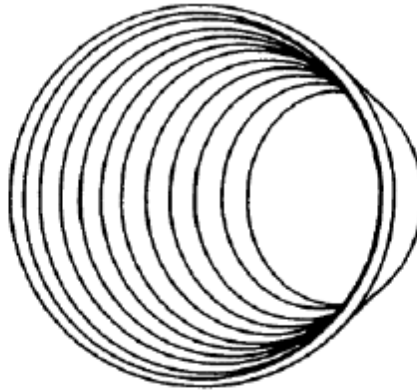
Examples of confined spaces include the following:

- Manholes;
- Crawl spaces;
- Tunnels;
- Tanks;
- Trenches;

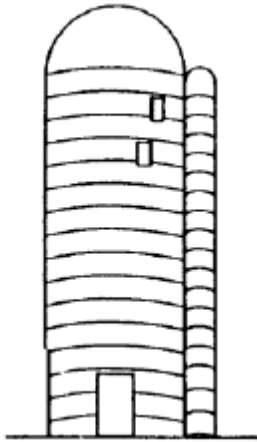
Types of Confined Spaces:



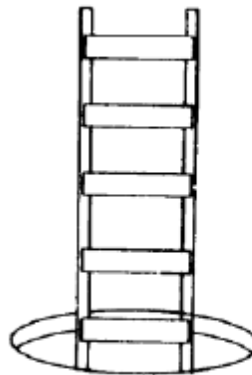
Storage Tank



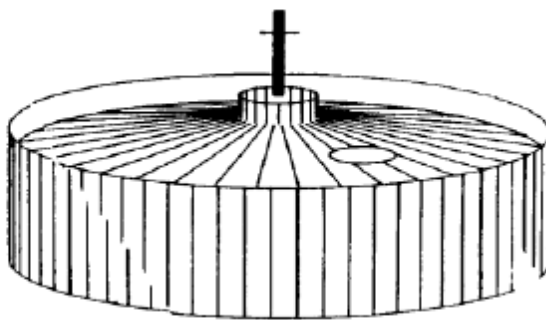
Pipeline



Silo



Manhole



Digester

Confined Spaces:

A. Definitions:

1. Confined Space:

- Any enclosed space with limited means of entry or egress, which is not designed for continuous occupation.

2. Permit-Required Confined Space:

- Confined space that contains actually or potentially hazardous atmosphere, or the potential for engulfment by particulate matter or liquid.

3. Entry:

- Physical act of entering a confined space. An entry occurs when a worker's face breaks the plane of the confined space opening.

4. Authorized Entrants:

- Properly trained workers with the authorization to enter confined spaces.

5. Authorized Attendant:

- Properly trained worker who is positioned outside a confined space. This person monitors the entrants within a confined space and the external surroundings

6. Person Authorizing Entry:

- Worker who is properly trained in administrative, technical, and managerial aspects of confined space entry. This person authorizes entry and has the authority to terminate entry when conditions become unfavorable.

7. Hazardous Atmosphere:

- Atmosphere that is oxygen enriched, oxygen deficient, combustible, toxic, or otherwise immediately dangerous to life or health.

8. Hotwork:

- Operations that could provide a source of ignition, such as riveting, welding, cutting, burning, or heating.

B. Employee Responsibilities:

All employees and contractors must follow the guidelines in the Amarillo College Confined Space Entry Program and other required programs to ensure safe entry into confined spaces. In addition, Departments and Supervisors are responsible for the following:

- Selecting a person to authorize entry;
- Authorizing entrants and attendants, as appropriate;
- Providing atmospheric monitoring equipment, personal protective equipment, and other necessary equipment;
- Training the people who authorize entry and the people who enter and attend confined spaces;

The Physical Plant is responsible for the following:

- Assisting with identifying confined spaces, as necessary;
- Assisting with training employees, as appropriate;
- Monitoring program compliance.

C. Safety Procedures:

The following sections cover proper procedures and guidelines for safely working within confined spaces.

NOTE:

Electrical manholes and other confined spaces with high voltage electrical hazards are covered by 29 CFR 1910.269.

Please refer to the code for more information.

1. Inspecting the Space and Completing the Checklist:

- Before entering a confined space, evaluate the area and complete a Confined Space Checklist Form and Entry Document,
 - A sample form addressing OSHA requirements is included after this section,
 - To complete the form, determine the following information:
 - Identity and location of the confined space,
 - Purpose for entering the area,
 - Known and potential hazards,
 - Required isolation methods (eg, lockout/tagout),
 - Environmental conditions of the confined space,

Atmospheric readings to verify that acceptable environmental conditions are met and maintained,
Rescue services, procedures, and equipment that may be necessary in case of an emergency,
Communication procedures to be used,
Personal protective equipment to be used,
Any additional information relating to the specific circumstances of the confined space,
Names of the following:
 Person authorizing entry,
 Supervisor,
 Authorized entrants,
 Authorized attendants.

!IMPORTANT!

If you intend to perform hotwork within the confined space, you must note this on the form.

2. Obtaining Entry Permission:

- Employees must notify the person who authorizes entry before working in confined spaces;
- The person who authorizes entry refers to any records on file and identifies the actual or potential hazards of the area in question,
 - If no file exists for the specific space, a new one is developed;
- The person who authorizes entry then reviews and approves the entry form as appropriate. A copy of the form is filed for future reference.

CONFINED SPACE CHECKLIST

Date of Entry: _____ Time: _____

Date of Completion: _____ Time: _____

Site Location (Identity): _____

I. PURPOSE OF ENTRY INTO SPACE

II. SITE PREPARATION

- | | |
|--|-----------------|
| 1. Work area isolated with signs/barriers? | Y _____ N _____ |
| 2. All power sources tagged/locked/tried? | Y _____ N _____ |
| 3. All input discharge lines capped/plugged? | Y _____ N _____ |
| 4. Contents drained/flushed/neutralized? | Y _____ N _____ |
| 5. Space cleaned of contaminant/purged? | Y _____ N _____ |
| 6. Space ventilated before entering? | Y _____ N _____ |

III. ATMOSPHERIC TESTING (pre-entry)

1. Has all test equipment been calibrated? Y _____ N _____

	Reading	Time	Initials
2. Oxygen Content:	_____ %	_____	_____
3. Flammable Concentration:	_____ % LEL	_____	_____
4. Toxic Concentration:	_____ PPM	_____	_____
5. Toxic Contaminant:	_____ PEL	_____	_____
6. Temperature Inside Space	_____	_____	_____

IV. EMERGENCY RESCUE PROCEDURES

PHONE 911 () RADIO CHANNEL ()

PAGE PHONE () # _____

Type of emergency/rescue equipment required:

V. SAFETY EQUIPMENT REQUIRED FOR ENTRY (check those required)

SCBA ()	Protective Clothing ()
Respirator ()	Escape Harness ()
Fire Extinguisher ()	Lifeline ()
Tripod Escape Unit ()	Gloves ()
Additional requirements:	

Portable atmospheric monitor required? Y _____ N _____

VI. HOT WORK

To be Performed Y _____ N _____

Type: _____

ENTRY DOCUMENT

I CERTIFY THAT I HAVE INSPECTED THE WORK AREA FOR SAFETY AND REVIEWED ALL PRECAUTIONS RECORDED ON THE CONFINED SPACE CHECKLIST.

Person Authorizing Entry x _____

Supervisor x _____

Entrant(s) x _____

 x _____

 x _____

 x _____

Attendant(s) x _____

 x _____

3. Preparing the Entry Team:

Before entering a confined space, all employees involved with the entry must attend a preparation meeting. The agenda for this meeting includes the following:

- Discussion of actual and potential hazards;
- Review of emergency procedures including rescue and evacuation;
- Completion of the entry form by all team members to acknowledge their understanding of the hazards involved with the confined space;
- Issuance of personal protective equipment;
- Discussion of site location and other essential information.

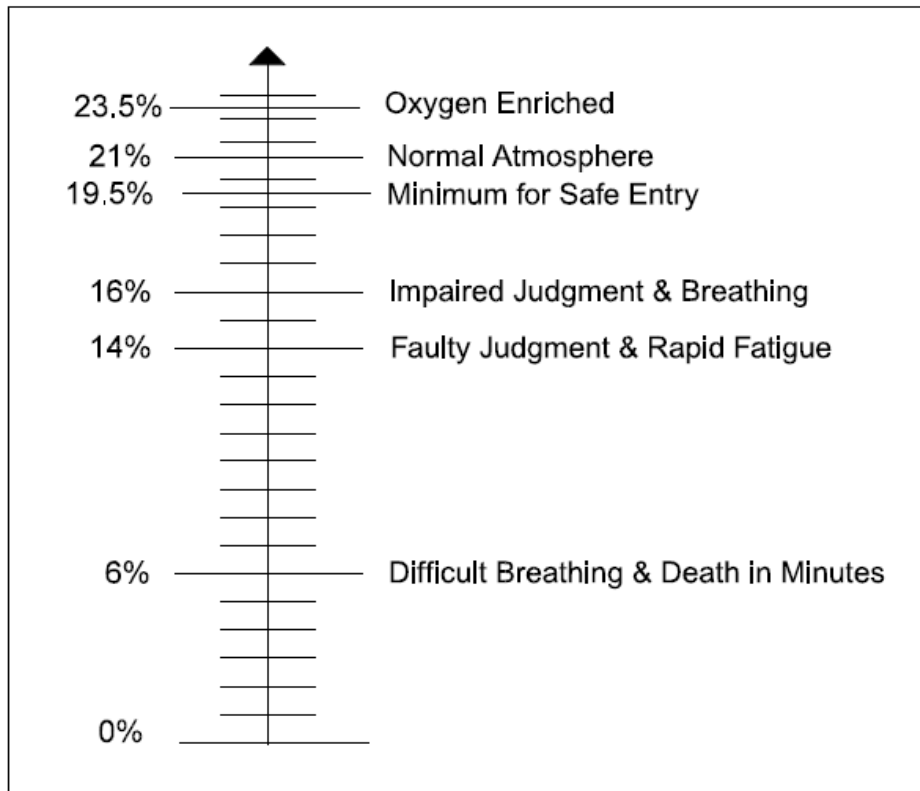
4. Monitoring the Atmosphere:

- Due to poor ventilation and physical structure, the atmosphere in confined spaces may be actually or potentially hazardous;
- Atmospheric hazards include the following:
 - Oxygen deficient or oxygen enriched atmospheres,
 - Combustible atmospheres,

- Toxic atmospheres,
- Any other atmosphere that is immediately dangerous to life or health;
- Employees trained in atmospheric monitoring will test several points in a confined space for the following:
 - Oxygen content,
 - Combustible atmosphere,
 - Potential toxic contaminants.

D. Oxygen Atmospheres:

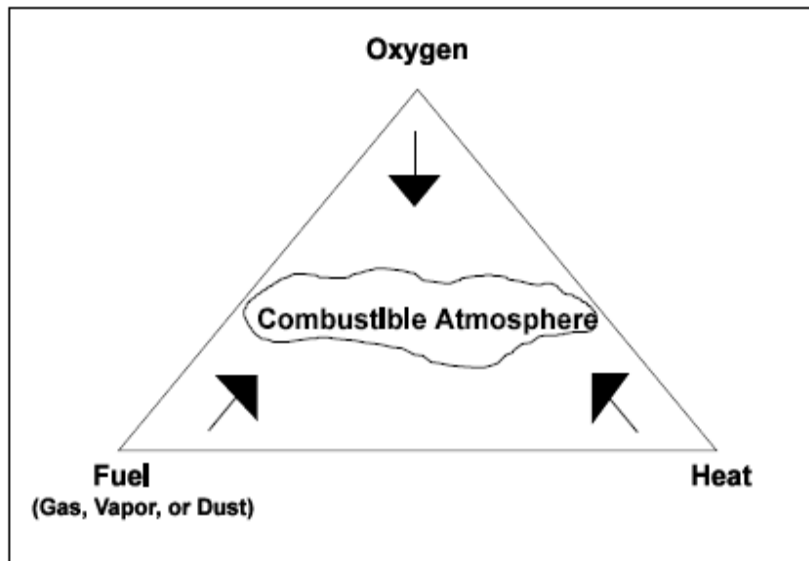
Oxygen enriched atmospheres are more than 23.5% oxygen; oxygen deficient atmospheres are less than 19.5% oxygen. Certain chemical or biological reactions may reduce oxygen over time, but employee operations such as cutting or welding may reduce oxygen content very quickly. Oxygen levels must be tested regularly whenever hotwork is performed within a confined space. The following graph outlines human reaction to various oxygen levels.



Human Reaction to Oxygen Concentrations

E. Combustible Atmospheres:

Combustible atmospheres have enough oxygen and flammable vapor, gas, or dust to ignite and support a fire or explosion if exposed to flames, sparks, or heat. Oxygen-enriched atmospheres and hazardous atmospheres in excess of their lower flammable limits are extremely combustible and dangerous. The following graphic illustrates the relationship between oxygen, heat, and fuel.



F. Toxic Atmospheres:

Toxic atmospheres can cause injury, illness, or death. Safety concerns include inhalation and skin exposure. If the identity of the toxic atmosphere is known, check all appropriate Material Safety Data Sheets (MSDSs) for threshold limit values and recommended personal protective equipment. If the identity of the toxic atmosphere is not known, use maximum PPE (ie, SCBA).

G. Ventilation:

Ventilation controls the atmospheric hazards of a confined space by replacing unsafe air with clean, breathable air. There are several methods for ventilating a confined space. The method and equipment used depend on the following factors:

- Size of the confined space;
- Atmosphere;
- Source of the makeup air.

For most confined spaces, fans or other air-moving equipment can provide adequate ventilation. Two common types of mechanical ventilation include local exhaust ventilation and general ventilation.

Local exhaust ventilation captures contaminants at their point of origin and removes them. This type of ventilation method is ideal for flammable and toxic materials produced at a single point (eg, hotwork and work involving cleaning solvents). When using this type of ventilation system, keep the exhaust intake close to your work. Do not use this type of ventilation system for contaminants that are widely dispersed or for confined spaces that make ventilation difficult. Instead, use general ventilation.

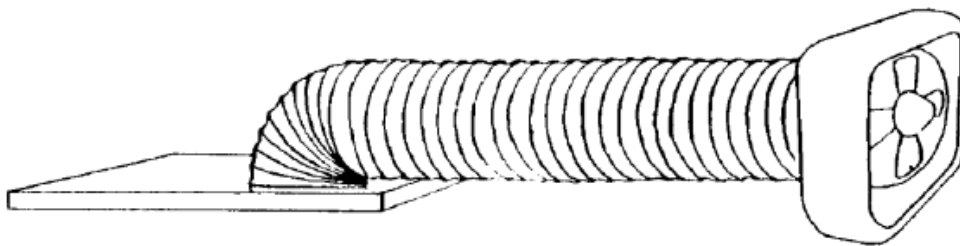
General ventilation flushes the atmosphere by supplying and exhausting large volumes of air. Because this system does not reduce the amount of contaminants released, it is not recommended for highly toxic atmospheres. General ventilation is ideal for providing oxygen and controlling low concentrations of materials that are not highly toxic. When using this type of ventilation system during hotwork, monitor the atmosphere continuously and wear a SCBA, as necessary.

!IMPORTANT!

Ventilation alone cannot reduce some atmospheric hazards to safe levels.
Use atmospheric testing to confirm whether the ventilation system has been successful.

Follow these guidelines for ventilating confined spaces:

- Begin ventilation in time to assure that the space is safe before entry,
- Test the atmosphere before entry to confirm that the ventilation system is working properly and that the space is safe;
- Continue ventilation as long as the space is occupied, or at least until the oxygen levels and hazardous concentrations are within safe limits;
- If work inside the space can make the air unsafe (eg, hotwork, painting, using solvents, sandblasting, etc) continue ventilating.



Ventilation System Example

H. Preparing the Site for Entry:

Employees must complete the following steps to prepare confined spaces for entry:

- Isolate the confined space entry site from the surrounding area using guards and barriers (including signs, rope, or tape);
- Drain, clean, ventilate, and/or purge the confined space, as necessary, to prevent flammable, toxic, and corrosive hazards;
- Isolate all electrical, mechanical, and pneumatic energy sources as outlined in the Lockout/Tagout section of this manual;
- Ensure that all workers are wearing appropriate personal protective equipment, and that all persons wearing respirators have been properly trained in their usage;
- Provide continuous ventilation, as necessary;
- Ensure that non-sparking tools and explosion proof equipment are used when working in a potentially combustible atmosphere;
- Position gas cylinders for cutting or burning outside the confined space;
- Ensure that a standby SCBA is available;
- Obtain personal protective equipment, including lifelines, winches, and harnesses, as required,
 - Ensure that the equipment has been inspected as scheduled;
- Take precautions to ensure against engulfment hazards, such as water, dirt, grain, etc.

I. Safeguarding Confined Space Operations:

Life support safety is critical during confined space operations. The following items are requirements for safeguarding confined spaces:

- Employees must wear appropriate personal protective equipment at all times;
- Employees must use harnesses, lifelines, and/or winches, as appropriate.

The Authorized Safety Attendant is specifically responsible for the following:

- Keeping a log of all authorized entrants working within the confined space;
- Maintaining constant verbal contact with the authorized entrants within a confined space;
- Taking necessary precautions and measures to prevent unauthorized persons from entering a confined space;
- Initiating evacuation procedures whenever conditions within or outside the confined space pose a new hazard.

All employees must evacuate a confined space when one or more of the following conditions occur:

- Authorized Safety Attendant orders evacuation;

- Automatic atmospheric alarm sounds;
- Authorized entrants believe they are in danger.

J. Emergency Procedure:

If a worker is unable to evacuate the confined space during an emergency, the Authorized Safety Attendant will contact rescue personnel by radio or other means. The Authorized Safety Attendant and other workers outside the confined space should attempt to hoist the worker out of the confined space using a lifeline.

!IMPORTANT!

Under no circumstances should unauthorized employees enter a confined space during an emergency.

K. Trenching and Shoring:

Some operations such as trenching result in confined spaces. Shoring systems are necessary to protect these spaces and reduce the chance for cave-ins.

A trench is a narrow excavation below the ground. Trenches are typically deeper than they are wide; however, the width of a trench is less than 15 feet.

A shoring system consists of a structure that supports the sides of an excavation and is designed to prevent cave-ins.

Employees must follow all the requirements associated with confined spaces when working within trenches

VII. Fire/Life Safety:

Fire/life safety involves numerous safety issues including fire prevention, fire suppression, and emergency evacuation/response. Fire/life safety is everyone's responsibility.

!IMPORTANT!

Learn how to prevent fires and respond to fires — what you learn will be invaluable.

Amarillo College is committed to providing a safe environment for building occupants and emergency response personnel. Amarillo College uses the codes of the cities in which our campuses are collocated in and nationally accepted codes as guidelines for inspections, testing, and procedures.

A. The Effects of a Fire:

Most fires produce an immense amount of smoke that is highly toxic. In fact, smoke is responsible for more fire fatalities than flames. A smoky fire can have the following effect on humans:

- Within 30 seconds – Disorientation;
- Within 2 minutes – Unconsciousness;
- Within 3 minutes – Death.

Timing is critical during a fire. To ensure your safety, you must know how to prevent and respond to any fire emergency.

B. Fire Prevention:

The greatest protection against property loss and injuries from fire is prevention.

Follow these guidelines to promote fire/life safety:

- Minimize combustible storage;
- Store waste materials in suitable containers;
- Use flammable materials in well-ventilated areas,
 - Use and store flammables away from ignition sources, such as cigarettes;
- Keep equipment in good working order;
- Have electrical wiring and appliances inspected regularly;
- Ensure that heating units are properly safeguarded;
- Do not hunt for gas leaks using a open flame,
 - Use approved gas indicators;
- Report and repair all gas leaks immediately;
- Conduct hot work in well-ventilated areas;
- Test enclosed or confined spaces for flammable atmospheres;
- Use open flames carefully;
- Do not use open flames where flammable atmospheres may be present.

For more information on fire/life safety, refer to other chapters in this manual, including Emergency Preparedness, Electrical Safety, Laboratory Safety, Chemical Safety, Confined Space, etc.

C. Fire Response:

If you see a fire or smoke, or if you smell smoke, complete the following steps:

- Pull the fire pull station to begin evacuating the building;
- If you are not in immediate danger, call 371-5163 to report the fire;

- Provide the operator with the following information:
 - Building or area name,
 - Approximate location of the fire,
 - Size and type of fire,
 - Your name.
- If you are formally trained in fire fighting techniques and are not in immediate danger, you may attempt to fight the fire.
- Do not place yourself or others in unnecessary danger.
- Exit the building by following posted evacuation routes Do not use elevators during an emergency.
- During actual emergencies, building occupants must receive permission from the College Police, the Fire Department, Physical Plant or the Emergency Manager before re-entering the building.

NOTE:

Evacuation plans and fire drills are essential for building occupants to respond correctly to a fire alarm.

Refer to the Emergency Preparedness chapter for more information.

D. Arson:

If you suspect arson, no matter how small the incident, contact College Police. Do not alter the fire scene in any way, unless you are trying to extinguish a live fire. College Police and the local Fire Department work together to investigate possible arson.

E. Combustible Storage:

By storing excess combustible materials improperly, employees not only increase the potential for having a fire, they increase the potential severity of a fire.

To reduce the hazards associated with combustible storage, follow these guidelines:

- Eliminate excess combustible materials such as paper and cardboard;
- Do not store combustible materials in hallways, stairwells, or mechanical rooms;
- When stacking combustible materials, leave at least 18 inches between the top of the stack and the ceiling .

F. Portable LPG:

The Texas Railroad Commission regulates the sale and use of Liquefied Petroleum Gas (LPG), including butane and propane.

These regulations govern several types of LPG-powered equipment including the following:

- Forklifts;

- Floor buffers;
- Cooking and heating equipment;
- Laboratory equipment.

Exhaust fumes may contain carbon monoxide which can present a health hazard. Exhaust can also create smoke which may activate a smoke detector. Take special precautions to ensure adequate ventilation when using these machines indoors.

Because LPG is extremely flammable, it is a potential fire hazard. Do not store LPG near heat, flame, or other ignition sources. In addition, do not leave portable LPG containers larger than 16 oz in a building overnight. Instead, place portable LPG containers and LPG equipment outside in a storage area that is at least 25 feet away from other buildings, combustible materials, roadways, railroads, pipelines, utility lines, and the property line. This storage area should prevent unauthorized entry and have a portable fire extinguisher within 25 feet. Refer to the Agriculture Safety chapter of this manual for more information on LPG.

G. Emergency Access and Egress:

Emergency access and egress are critical during an emergency situation such as a fire. During a fire, timing and quick response are essential to save lives and property. Effective emergency access ensures that fire trucks can reach a building in time to extinguish the fire.

Unobstructed emergency egress ensures that building occupants can exit a building to safety.

These definitions help clarify the concept of emergency access and egress:

Emergency Access:

- Pertinent Physical Plant and equipment remain available and unobstructed at all times to ensure effective fire detection, evacuation, suppression, and Response.

Emergency Egress:

- A continuous and unobstructed way to travel from any point in a public building to a public way. A means of egress may include horizontal and vertical travel routes, including intervening rooms, doors, hallways, corridors, passageways, balconies, ramps, stairs, enclosures, lobbies, courts, and yards.

!IMPORTANT!

Each location within a building must have a clear means of egress to the Outside.

The following sections offer safety guidelines and procedures for maintaining emergency access and egress:

1. Corridors, Stairways, and Exits:

An exit corridor and/or stairway is a pedestrian pathway that allows direct access to the outside of a building and/or allows access to a building entrance and subsequent pathways to the outside of a building (ie, an exit corridor is the quickest, easiest, and most direct pathway for leaving a building). Because exit corridors or passageways are the primary means of egress during an emergency, employees must follow the safety guidelines outlined in this section.

!IMPORTANT!

There must be at least 44 inches clear width of unobstructed, clutter-free space in all corridors, stairways, and exits.

Follow these guidelines to promote safe evacuation in corridors, stairways, and exits:

- Keep all means of egress clean, clutter-free, and unobstructed;
- Do not place hazardous materials or equipment in areas that are used for evacuation;
- Do not use corridors or stairways for storage or office/laboratory operations,
 - Corridors may not be used as an extension of the office or laboratory.

2. Fire Lanes:

A fire lane is an area designated for emergency personnel only. It allows them to gain access to building and/or fire protection systems. Although most fire lanes on campus are clearly marked, not all fire lanes are easy to distinguish. Amarillo College has a program in place to clearly mark all fire lanes.

!IMPORTANT!

Do not park in fire lanes or within 15 feet of fire hydrants and other fire Equipment.

3. Fire Doors:

A fire door serves as a barrier to limit the spread of fire and restrict the movement of smoke. Unless they are held open by the automatic systems, fire doors should remain closed at all times. Do not tamper with fire doors or block them with equipment, potted plants, furniture, etc.

Fire doors are normally located in stairwells, corridors, and other areas required by Fire Code. The door, door frame, locking mechanism, and closure are rated between 20 minutes and three hours. A fire door rating indicates how long the door assembly can withstand heat and a water hose stream.

Always keep fire doors closed. If it is necessary to keep a fire door open, have a special closure installed. This closure will connect the fire door to the building's fire alarm system, and will automatically close the door if the alarm system activates.

!IMPORTANT!

Know which doors are fire doors and keep them closed to protect building occupants and exit paths from fire and smoke.

Never block a fire door with a non-approved closure device such as a door stop, block of wood, or potted plant.

For fire doors with approved closure devices, make sure that nothing around the door can impede the closure.

Never alter a fire door or assembly in any way. Simple alterations such as changing a lock or installing a window can lessen the fire rating of the door.

Doors to offices, laboratories, and classrooms help act as smoke barriers regardless of their fire rating. Keep these doors closed whenever possible.

REMEMBER:

A closed door is the best way to protect your path to safety from the spread of smoke and fire.

H. Fire Detection and Notification:

Amarillo College uses several types of fire detection and notification systems including heat detectors, smoke detectors, pull stations, and horns and lights.

The following sections discuss these components:

1. Heat and Smoke Detectors:

Some of the fire detectors at Amarillo College are linked to the College Police. Others produce a local alarm. The buildings with a reporting fire alarm, once the building alarm system is activated, the Reporting System alerts the College Police who initiates the emergency response.

Those buildings with local alarms once they are activated you should report to College Police that the fire alarm has been activated.

There are two types of fire detection devices used at Amarillo College:

- heat detectors;
- and smoke detectors.

Please note the location of the detectors in your area and prevent damage and accidental activation.

a) Heat Detectors:

Heat detectors respond to the convected energy in hot smoke and fire gases (ie, heat). Heat detectors are normally located in laboratories, mechanical rooms, storage areas, and areas that could produce high levels of dust, steam, or other airborne particles.

b) Smoke Detectors:

Smoke detectors respond to the solid and liquid aerosols produced by a fire (ie, smoke). Since smoke detectors cannot distinguish between smoke particles and other particles such as steam, building occupants must be aware of detector locations and be considerate when working around them. Smoke detectors are normally found in exit corridors, office areas, and assembly areas.

If your work produces steam, dust, or an environment that could damage or activate a detector, contact Physical Plant to review the installation and/or allow temporary disarming.

Important!

Ionization smoke detectors contain a radioactive material, contact the Emergency Manager for instructions on disposal.

2. Alarm Systems: Pull Stations:

Fire alarm manual pull stations are installed to manually activate a building's alarms in addition to the automatic fire sensing devices. When pulled manually, a pull station activates the fire alarm system and notifies College personnel that an emergency exists. Pull stations are located near exit stairways and/or building exits. If you smell smoke or if you see smoke or a fire, complete these steps:

- Pull a manual pull station to evacuate the area;
- If you are not in immediate danger, call 371-5911;
- If you are trained in fire fighting and it is reasonably safe to do so, attempt to extinguish the fire.

3. Alarm Systems: Horns and Lights:

Emergency horns/bells and lights are located throughout College buildings with fire alarm systems. They are typically found near emergency pull stations. Do not block emergency horns or lights. Report damaged or defective horns and lights to the Physical Plant.

I. Fire Suppression:

Amarillo College uses various types of fire suppression equipment including portable fire extinguishers, sprinklers, halon systems, carbon dioxide systems, and fire hose/standpipe systems.

The following sections discuss each type of fire suppression equipment:

1. Fire Extinguishers:

Fires are classified according to three basic categories. Each type of fire extinguisher requires special treatment to control and extinguish it. Therefore, all fire extinguishers are clearly marked to indicate the fire classes for which they are designed. Fires are classified as indicated below. Refer to the table on the following page for additional information.

a) Class A:

Fires involving ordinary combustibles such as wood, textiles, paper, rubber, cloth, and trash. The extinguishing agent for a Class A fire must be cool Water and multi-purpose dry chemical fire extinguishers are ideal for use on these types of fires.

b) Class B:

Fires involving flammable or combustible liquids or gases such as solvents, gasoline, paint, lacquer, and oil. The extinguishing agent for a Class B fire must remove oxygen or stop the chemical reaction. Carbon dioxide, multi-purpose dry chemical and halon fire extinguishers are ideal for use on these types of fires.

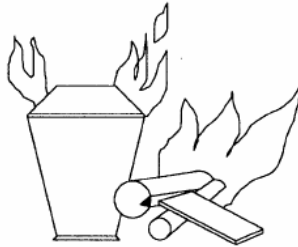
c) Class C:

Fires involving energized electrical equipment or appliances. The extinguishing agent for a Class C fire must be a nonconducting agent. Carbon dioxide, multi-purpose dry chemical, and halon fire extinguishers are ideal for use on these types of fires. Never use a water fire extinguisher on a Class C fire.

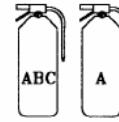
Your Extinguisher Must Fit The Fire

Type of Fire

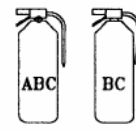
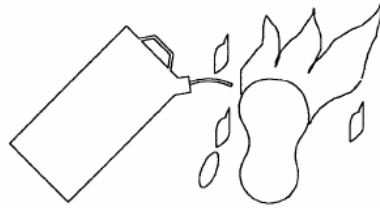
Type A: Ordinary combustibles, such as wood, cloth, paper, rubber, and many plastics.



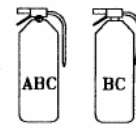
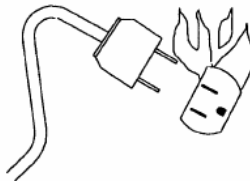
Type of Extinguisher



Type B: Flammable liquids, such as gasoline, oil, grease, oil-based paints, tar, lacquer and flammable gas.



Type C: Energized electrical equipment, including wiring, fuse boxes, circuit breakers, machinery and appliances.



A - Water

BC - Dry Chemical or Carbon Dioxide

ABC - Dry Chemical

d) Inspection, Testing, & Recharging:

Physical Plant, either directly or through vendors inspects and tests fire extinguishers regularly, removing extinguishers that must be recharged or replaced. To move a fire extinguisher to a new location or report a missing or damaged fire extinguisher, call the Physical Plant at 345-5560.

e) Using Fire Extinguishers:

Most fire extinguishers provide operating instructions on their label; however, the time to learn about fire extinguishers is not during a fire. The sooner you know how to use a fire extinguisher, the better prepared you are.

NOTE:

Portable fire extinguishers are located throughout all College buildings. They are mounted in readily accessible locations such as hallways, near exit doors, and

areas containing fire hazards. Make sure that fire extinguishers are accessible and securely mounted.

The Physical Plant can arrange fire extinguisher classes. When using a fire extinguisher to fight or control a fire, aim the spray at the base of the fire. Because most extinguishers only work for a short time, employ a sweeping motion and work quickly to control the fire.

!IMPORTANT!

Do not attempt to fight a fire unless it is small and controllable.

Use good judgment to determine your capability to fight a fire.

When fighting a fire, always maintain an escape route.

Never allow a fire to block your egress.

f) PORTABLE EXTINGUISHERS AND AUTOMOBILES:

All college-owned vehicles in excess of 20 horsepower should contain a 2 ½ or 5 pound A-B-C class fire extinguisher.

2. Sprinkler Systems:

The purpose of water sprinkler systems is to help extinguish and minimize the spread of fires. Sprinklers are normally activated only by heat. To ensure that sprinklers are effective in the event of a fire, maintain at least 18 inches of clearance between any equipment or storage items and the ceiling (Anything close to the ceiling can defeat the sprinkler system). Never hang anything from a sprinkler head. Arrange work areas to facilitate sprinklers and allow even water distribution.

3. Halon and Carbon Dioxide Systems:

Special work areas, such as computer rooms and chemical storage rooms, may contain specialized fire suppression systems. For example, many computer rooms contain halon systems and many chemical storage rooms contain carbon dioxide systems. Areas with special fire suppression systems may be clearly identified on the room door.

People who work in these areas must do the following:

- Keep all room doors and windows closed;
- Know how the fire suppression system works (ie, operation, abort switch, etc);
- Do not tamper with ceiling tiles.

If you have any questions about supplemental fire suppression systems, please contact the Physical Plant.

4. Fire Hoses and Standpipe Systems:

Fire hose cabinets are located in several buildings near the exit stairwells and in corridors. Employees who use a fire hose to extinguish a fire should have received training to ensure proper usage and safety.

J. Open Burning:

Amarillo College must comply with TCEQ and the City Fire Departments in which a campus is collocated, regulations for open burning.

Follow these steps before burning anything outside:

- Only natural ground cover may be burned. It is not acceptable to store items for burning at a later date. Open burning must only be used as a way to remove brush and other acceptable items if no alternate removal can be used.
- Smoke and flying debris may not cross or contact public thoroughfares.
- Responsible persons must be present during the entire burn, be equipped with adequate fire fighting agents, and be able to quickly communicate with emergency response personnel.
- Never burn while a fire watch is in effect (Red Flag Warning).

Please contact the Physical Plant or Emergency Manager for additional information on open burning and alternative methods of disposal and for obtaining permits

K. Holiday Decorations:

Holiday decorations are often fire hazards.

Follow these guidelines to improve fire safety during the holidays:

- Do not use live Christmas trees in College buildings unless they are treated with fire retardants;
 - Use an artificial tree that is fire resistant;
- Do not place holiday decorations where they may block emergency egress (eg, stairways, corridors, near doors, etc);
- Only use decorations that are flame retardant;

- Practice good housekeeping by minimizing paper and other combustible decorations;
- Avoid using extension cords. If you must use an extension cord, use a heavy gauge cord and place it in plain view. Make sure the cord does not pose a tripping hazard;
- Use FM or UL labeled electrical decorations;
- Do not light candles or use other decorations with open flames;
- Turn off lights when the room is unoccupied.

L. Open Flame:

Open flames are not permitted on campus without prior permission from the Physical Plant and College Police. Departments planning an activity involving open flames, eg candles, special effects, must coordinate the event with the Physical Plant, College Police and Emergency Manager.

VIII. Emergency Preparedness Elements:

An emergency consists of any situation that poses immediate and extreme danger to people, property, or process. Because most emergencies are sudden, severe, and unexpected, it is extremely important to be prepared for a possible emergency.

Proper preparation helps ensure safety and survival. A written emergency response or action plan is the best preparation tool for handling emergencies. To ensure effectiveness, review the College's and your Departments emergency response plans regularly.

Amarillo College has developed an emergency response plan entitled the Amarillo College Emergency Prevention and Response Manual (EPRM). A copy of the EPRM can be reviewed or downloaded from the College Web at:

http://www.actx.edu/forms/vlist/uop/view_group/group/14

Divisions and Departments are encouraged to develop emergency response or action plans specific to their needs, to a building, floor, classroom or laboratory. Division and Department specific emergency or action plans do not superseded the EPRM but are Appendices to the EPRM.

Make sure that each response plan includes the following information:

- Procedure for sounding alarms;
- Emergency escape procedures and escape route assignments;
- Emergency procedures for employees and students with special needs;
- Rescue and medical assistance requirements;
- Names of persons or departments to contact for more information on handling emergencies;

- Method for reporting emergencies;
- Provision for training emergency procedures.

A. Handling Emergencies:

Regardless of the type of emergency in progress, you should call College Police at 371-5911 and/or sound the fire alarm immediately. Remain calm, notify others, and respond to the emergency as appropriate. Do not attempt to handle any emergency situation in which you do not have training (eg, fire fighting, first aid, spill response, etc).

!IMPORTANT!

Call College Police 371-5911 and/or pull the fire alarm whenever a situation poses immediate danger to people, property, or property. College Police are the focal point for emergency communications for all emergencies arising on or impacting Amarillo College. Do not assume by calling 911 College have been or will be notified of the emergency situation. If you call 911 first, please immediately call College Police 371-5911.

When you call to report an emergency, provide the operator with the following information:

- Building or area name;
- Location;
- Brief description of the emergency;
- Your name.

The following sections offer specific safety guidelines and procedures for handling different types of emergencies:

1. Bomb Threats:

Bomb threats and other threats of violence are serious emergencies that required prompt attention. Although bomb threats are rare, they are most likely to occur during final exams. The following sections offer guidance for handling bomb threats:

a) How to Handle a Threatening Phone Call:

If you receive a bomb threat over the phone, remain calm and act courteous. If feasible, notify another person to listen on another extension. Take notes on the caller's threat, tone, voice characteristics, and background noise.

If the caller seems talkative, ask questions such as the following:

- What exactly is the threat?
- Is the voice familiar in any way?

- Male or female?
- Young or old?
- Calm? Angry?
- Speech Impediments? Accent?
- What sounds are familiar in the background?
- Record the caller's words, if possible.
- When is the bomb going to explode?
- What does it look like? What kind is it?
- What will cause it to explode?
- Where is the bomb?
- Who placed the bomb?
- Why was the bomb placed?

A helpful checklist for documenting details is provided on the following page.

BOMB THREAT CALL PROCEDURES

Most bomb threats are received by phone. Bomb threats are serious until proven otherwise. Act quickly, but remain calm and obtain information with the checklist on the reverse of this card.

If a bomb threat is received by phone:

1. Remain calm. Keep the caller on the line for as long as possible. DO NOT HANG UP, even if the caller does.
2. Listen carefully. Be polite and show interest.
3. Try to keep the caller talking to learn more information.
4. If possible, write a note to a colleague to call the authorities or, as soon as the caller hangs up, immediately notify them yourself.
5. If your phone has a display, copy the number and/or letters on the window display.
6. Complete the Bomb Threat Checklist (reverse side) immediately. Write down as much detail as you can remember. Try to get exact words.
7. Immediately upon termination of the call, do not hang up, but from a different phone, contact FPS immediately with information and await instructions.

If a bomb threat is received by handwritten note:

- Call _____
- Handle note as minimally as possible.

If a bomb threat is received by e-mail:

- Call _____
- Do not delete the message.

Signs of a suspicious package:

- No return address
- Excessive postage
- Stains
- Strange odor
- Strange sounds
- Unexpected Delivery
- Poorly handwritten
- Misspelled Words
- Incorrect Titles
- Foreign Postage
- Restrictive Notes

DO NOT:

- Use two-way radios or cellular phone; radio signals have the potential to detonate a bomb.
- Evacuate the building until police arrive and evaluate the threat.
- Activate the fire alarm.
- Touch or move a suspicious package.

WHO TO CONTACT (select one)

- Follow your local guidelines
- Federal Protective Service (FPS) Police
1-877-4-FPS-411 (1-877-437-7411)
- 911

BOMB THREAT CHECKLIST

Date: Time:

Time Caller Hung Up: Phone Number where Call Received:

Ask Caller:

- Where is the bomb located?
(Building, Floor, Room, etc.)
- When will it go off?
- What does it look like?
- What kind of bomb is it?
- What will make it explode?
- Did you place the bomb? Yes No
- Why?
- What is your name?

Exact Words of Threat:

Information About Caller:

- Where is the caller located? (Background and level of noise)
- Estimated age:
- Is voice familiar? If so, who does it sound like?
- Other points:

Caller's Voice

- ☐ Accent
- ☐ Angry
- ☐ Calm
- ☐ Clearing throat
- ☐ Coughing
- ☐ Cracking voice
- ☐ Crying
- ☐ Deep
- ☐ Deep breathing
- ☐ Disguised
- ☐ Distinct
- ☐ Excited
- ☐ Female
- ☐ Laughter
- ☐ Lisp
- ☐ Loud
- ☐ Male
- ☐ Nasal
- ☐ Normal
- ☐ Ragged
- ☐ Rapid
- ☐ Raspy
- ☐ Slow
- ☐ Slurred
- ☐ Soft
- ☐ Stutter

Background Sounds:

- ☐ Animal Noises
- ☐ House Noises
- ☐ Kitchen Noises
- ☐ Street Noises
- ☐ Booth
- ☐ PA system
- ☐ Conversation
- ☐ Music
- ☐ Motor
- ☐ Clear
- ☐ Static
- ☐ Office machinery
- ☐ Factory machinery
- ☐ Local
- ☐ Long distance

Threat Language:

- ☐ Incoherent
- ☐ Message read
- ☐ Taped
- ☐ Irrational
- ☐ Profane
- ☐ Well-spoken

Other Information:



Homeland
Security

!IMPORTANT!

If you receive a threatening phone call, remain calm and take Notes.
Try to find out as much as possible about the caller and threat.

b) College Police Response to Bomb Threats:

College Police regard all bomb threats as serious. After learning of a bomb threat, College Police will notify the appropriate official(s) and ask them to notify key personnel. Together, the Physical Plant personnel and the College Police will search the building, including trash cans and restrooms, for anything suspicious or out of the ordinary. After interviewing the person who received the bomb threat, College Police will determine if the threat appears to be a hoax or an actual emergency.

College Police have the authority to evacuate a building if circumstances warrant this precaution. The appropriate official may evacuate the building at their discretion based on the nature of the threat. Building evacuations may be conducted by sounding the fire alarm. If a fire alarm is used in response to a bomb threat, College Police will advise the Fire Department.

c) Handling Suspicious-Looking Items:

If you locate a suspicious-looking item, do not handle the item. Clear the area of personnel and notify College Police immediately. If necessary, College Police will call other first responder for assistance.

d) Bomb Threat Observations:

For most bomb threats, the caller announces that a bomb is set to go off at a certain time and then hangs up. Because routine bomb threat evacuations may spawn numerous hoax calls, consider the following:

Most intended explosions have no warning. Usually, after the bomb is detonated, a party claims credit and then explains why the bomb was set.

In cases where an actual device is located, the caller usually provides specific information for finding the device before the detonation time.

With few exceptions, bomb threats on campus are hoaxes designed to avoid or postpone an unpleasant task (eg, exam).

Amarillo College policy is to use restraint from evacuating buildings based on the following:

- A bomb that is set to detonate at a certain time is either a timed explosive device or a site-activated device. Both devices require considerable

expertise to develop. Furthermore, a site activated device, such as a radio-controlled mechanism, must be activated in close proximity of the bomb.

- Unless a bomb contains a large amount of volatile explosive (eg, C-4 plastic), damage will be limited to the immediate area of the Detonation.

2. Emergency Power:

Some buildings on campus provide automatic emergency power during electrical outages. The emergency power only supports essential life safety equipment such as elevators, corridor lighting, fire alarms, and exit lighting. Some new buildings have red emergency power outlets for essential equipment and machinery. Contact the Physical Plant to determine if other emergency outlets are available in your work area.

There are three types of emergency power sources:

- Portable generators;
- Building generators;
- Battery power packs.

Contact the Physical Plant for more information on emergency power.

B. Evacuation Plans:

1. Developing a Plan:

Amarillo College has developed an Evacuation Plan. A copy of the Evacuation Plan is contained in the Emergency Prevention and Response Manual. A copy of the EPRM can be reviewed or downloaded from the College Web at:

http://www.actx.edu/forms/vlist/uop/view_group/group/14

Divisions and Departments are encouraged to develop evacuation plans specific to their needs, for a building, floor, classroom or laboratory. Division and Department specific evacuation plans do not superseded the EPRM but are Appendices to the EPRM. In developing a Division or Department specific evacuation, or fire drills they should consider the following when developing the plan:

- Contact the Emergency Manager for assistance in developing an evacuation plan for your building, office, classroom, laboratory or work area,
- Building evacuation routes or maps should provide accurate layout of the building and multiple exit routes from any location. These plans must be posted

- in prominently traveled areas (eg, hallways, stairwells, etc). Unusual building layouts require more evacuation maps to be posted;
- Building floor plans used for evacuation plans are prepared by Physical Plant;
 - Special attention must be given to evacuation procedures for persons with disabilities. Even if no known building occupants have special needs, the evacuation plan must contain these provisions to ensure the safety of visitors or others with special needs;
 - A preplanned meeting place for evacuated occupants should be at least 200 feet from the building and clear of fire hydrants and access roads;
 - Certain people on each floor should be responsible for the following:
 - Ensuring that persons on the floor are aware of an emergency and the need to evacuate,
 - Ensuring that building evacuation routes are clearly posted in prominently traveled areas,
 - Ensuring that new employees are familiar with evacuation and fire drill procedures;
 - A written plan for emergencies and fire drills is essential for each college building. Studies show that when occupants discuss, plan, implement, and practice evacuation plans, they are better able to protect themselves and others;
 - The figure below shows a typical evacuation plan posted in College buildings:

POLK ST. BUSINESS and INDUSTRY CENTER

TORNADO SAFETY AREAS--

DO NOT LEAVE THE BUILDING!

PROCEED TO THE DESIGNATED TORNADO SAFETY AREAS MARKED IN YELLOW ON MAP!

ALL PERSONS REMAIN IN SAFETY AREAS UNTIL ALL-CLEAR IS GIVEN!



FIRE EVACUATION PROCEDURES--

DO NOT USE ELEVATORS! EXIT ALL ROOMS AND CLOSE DOORS!

EXIT THE BUILDING BY THE NEAREST SAFE EXIT MARKED IN RED ON MAP!

NOTIFY CAMPUS POLICE/SECURITY DEPARTMENT @ ext. #5163.

C. Conducting Evacuation Drills:

Amarillo College is not required to, nor does it require evacuation drills. If building occupants, Divisions or Departments conduct an emergency evacuation drill, they should consider the following:

- A safe and orderly evacuation is more important than a quick evacuation;
- Evacuation drills are only conducted by or under the direction of the Emergency Manager.

Before conducting a practice evacuation drill, the Emergency Manager or his/her representatives will do the following:

- Notify the College Police dispatch operator so they do not contact the local first responders (fire department);
- Invite stake holders, the Threat Response Team, local first responders, Division and Department Heads to participate or observe the conduct of the drill.

Practice evacuation drills should proceed as follows:

- Evacuation drills should involve all occupants;
- Everyone should leave the building when the fire alarm sounds;
- A person may be exempt from an evacuation drill if it will cause undue hardship (eg, interrupt an experiment);
- However, exemptions are strongly discouraged;
- Occupants should close (not lock) doors as they leave the work area,
 - Items that require security may be placed in a locking file cabinet or desk drawer on the way out;
- Department administrators should check all rooms and close doors on their way out;
- All building occupants should gather in the preplanned, pre-designated assembly area;
- Department administrators should take a head count (accountability check) to determine if all occupants have left the building;
- Upon completion of the drill, the Emergency Manager will complete an Evacuation Drill Checklist and forward it to the affected department heads.

D. First Aid:

First aid training is necessary to prevent and treat sudden illness or accidental injury. The primary objective of first aid is to save lives. This objective is achieved with the following:

- Preventing heavy blood loss;
- Maintaining breathing;
- Preventing further injury;
- Preventing shock;
- Getting the victim to a physician or Emergency Medical Service (EMS).

People who provide first aid must remember the following:

- Avoid panic;
- Inspire confidence;
- Do only what is necessary until professional help is obtained.

1. Initial First Aid:

If you are the first one on the scene of a medical emergency, your first priority is to remain calm. Your action will vary depending upon the nature of the situation, but the following four rules apply to any medical emergency:

Assess the Situation:

- Can you safely approach the victim?
- If not, what can you do to help without threatening your own safety?
- Determine what is wrong with the victim.

Set Priorities:

- Is the victim conscious?
- How serious is the emergency?
- Can someone else call EMS, if necessary?
- If no one else is available, decide if it is more important to administer first aid immediately or to call EMS and leave the victim unattended.

NOTE:

Never leave a victim in a life-threatening situation without first trying to help.

4. Snake Bites:

Most snakebites are not fatal. If a snake bite occurs, follow these steps:

- Have the victim move as little as possible;
- Apply a constricting bandage (not a tourniquet) between the wound and the heart;
- If possible, call for Emergency Medical Services,
 - In rural locations, transport the victim to the nearest hospital immediately,
 - If necessary and possible, carry the victim to transportation,
 - Do not let the victim walk.

If you cannot obtain medical attention:

- Do not make any incisions or suck out the poison;
- Do not cool the bitten area;
- Every fifteen minutes, loosen the constricting bandage for a few seconds and then reapply it.

E. Spill Response:

Shops, labs, and areas with hazardous chemicals should have spill clean-up supplies on hand. Call 371-5911 (College Police) to report potential hazards from:

- oil spills, fuel spills, chemical spills and other spills. College Police will contact the Emergency Manager, Physical Plant and local first responders. The Amarillo Fire Department has an Emergency Response Team that is equipped and trained to handle spills. See the Chemical Safety chapter for more information on chemical spill response procedures. See the Biological Safety chapter for more information pertaining to spills of biological materials. For spills of hazardous waste refer to procedures in the EPRM.

F. Weather Emergencies:

Weather emergency concerns for the Texas Panhandle include but are not limited to: high winds, severe winter storms, critical fire weather (red flag warning), heavy rains, hail, lightning, flash flooding, and tornadoes. The Amarillo College community is urged to monitor the weather. Because the host cities of Amarillo College campuses have an early warning system for weather emergencies that provides notice only to those person outdoors, a weather emergency radio or Suddenlink Cable can be used to monitor changing weather conditions and act accordingly. The following sections provide general guidelines for handling various weather emergencies:

1. Heavy Rain/High Winds/Flash Flooding:

Heavy rain and high winds provide dangerous driving conditions. Because flooding is a common problem in the Texas Panhandle, motorists should be aware of local weather conditions and avoid roads that tend to flood in heavy rains.

!IMPORTANT!

Do not drive in flooded areas or attempt to cross moving water in an automobile. Moving water can easily capsize a car or truck and drown the victim. Avoid creeks, low water crossings, rivers, ditches, and flooded roads during heavy rains. Keep children from playing in these areas during inclement weather.

High winds can topple trees, outdoor equipment, and electrical lines. Avoid downed power lines and notify the utility company of power outages. If an electrical line falls across your car, do not move the car or try to get out. Stay where you are until help arrives.

2. Lightning:

Lightning is nature's worst destroyer. A typical lightning bolt contains several hundred million volts at 30,000 or more amperes. Lightning need not strike a person directly to be dangerous. Lightning can crash down from virtually clear

sky. Stay away from open doors or windows during an electrical storm. Avoid using the telephone or television set and keep clear of all metal objects such as pipes and electrical appliances during a storm. Do not go outside.

If you find yourself caught in a storm away from a protected building:

- Avoid tree lines;
- Stay away from unprotected storm shelters;
- Stay away from flag poles, towers, and metal fences;
- Do not wade, swim, or go boating in a thunderstorm;
- A closed automobile provides a protective metal shell;
- If caught in the open, stay low.

3. Winter Weather:

Winter Storm Watch:

Hazardous winter weather conditions including significant accumulations of snow and/or freezing rain and/or sleet are possible generally within 36 hours. A winter storm watch means conditions are favorable for a hazardous winter weather event in and close to the watch area; for a combination of two or more of the following winter weather events; heavy snow, freezing rain, sleet, and strong winds.

Winter Storm Warning:

Hazardous winter weather conditions that pose a threat to life and/or property are occurring, imminent, or highly likely. The generic term, winter storm warning, is used for a combination of two or more of the following winter weather events; heavy snow, freezing rain, sleet, and strong winds.

People should take special precautions for extreme winter weather to ensure safety. Wear appropriate clothing for local weather conditions and keep your vehicle in good working order. If the roads become slick with ice, use extreme caution or avoid driving.

- Slippery streets increase stopping distances,
 - Drive slowly in winter weather;
- Choose footwear that provide the best footing for the weather;
- Clear walkways and steps of snow and ice;
- Use handrails where available;
- Clean snow and ice from all vehicle windows.

4. Tornado:

Tornadoes produce violent winds that can damage homes, vehicles, people, and wildlife. The primary dangers associated with tornadoes are high winds and flying debris. Severe thunderstorms and hail commonly precede a tornado. A dark funnel cloud or roaring noise (like a train) is evidence of an actual tornado. A tornado watch is issued when weather conditions are ideal for a tornado to form. A tornado warning is issued when a tornado is actually identified in the immediate vicinity.

If a tornado warning is issued, seek shelter immediately. Stay away from windows, doors, and outside walls.

Do not drive to shelter, unless you are already in a vehicle when the warning is issued. Drive to the nearest building or seek shelter in a ditch or ravine.

Never try to outrun a tornado in your vehicle.

If you are in a school, hospital, factory, shopping mall, or other public area, go to the designated shelter area. Interior halls on the lowest floors are usually best.

If you are at a home or in a building, go to an interior room on the lowest level (eg, bathroom, closet, hall, etc). Get under a piece of sturdy furniture if possible.

5. Red Flag Warning:

Is a forecast warning issued by the United States National Weather Service to inform area firefighting and land management agencies that conditions are ideal for wildland fire ignition and propagation. After drought conditions, and when humidity is very low, and especially when high or erratic winds which may include lightning are a factor. Red Flag Warning is a critical statement for the public, a Red Flag Warning means high fire danger with increased probability of a quickly spreading vegetation fire in the area within 24 hours.

The weather criteria for fire weather watches and red flag warnings varies with the Weather Service Office's warning area based on the local vegetation type, topography, and distance from major water sources but usually includes the daily vegetation moisture content calculations, expected afternoon high temperature, afternoon minimum relative humidity and daytime wind speed.

Amarillo College bans outdoor burning on Red Flag Warnings. The Cities in which Amarillo College campuses are collocated may also ban outdoor burning. The Amarillo College community should be prepared to evacuate a campus should a wildfire threaten it. The Amarillo College community should monitor local weather and news channels during Reg Flag Warnings.

IX. Personal Protective Equipment:

Personal Protective Equipment (PPE) includes all clothing and work accessories designed to protect employees from workplace hazards. Protective equipment should not replace engineering, administrative, or procedural controls for safety — it should be used in conjunction with these controls. Employees and Students must wear protective equipment as required and when instructed by a supervisor or instructor.

!IMPORTANT!

Always remove protective clothing before leaving the work area. Do not wear PPE in public elevators, classrooms, restrooms, breakrooms, etc .

A. Arm and Hand Protection:

Arms and hands are vulnerable to cuts, burns, bruises, electrical shock, chemical spills, and amputation.

The following forms of hand protection are available for employees:

- Disposable exam gloves;
- Rubber gloves;
- Nitrile gloves;
- Neoprene gloves;
- Leather gloves;
- Nonasbestos heat-resistant gloves;
- Metal-mesh gloves for meat cutters;
- Cotton gloves.

Always wear the appropriate hand and arm protection. Double your hand protection by wearing multiple gloves when necessary (eg, two pairs of disposable gloves for work involving biological hazards). For arm protection, wear a long-sleeved shirt, a laboratory coat, chemical-resistant sleeves, or gauntlet-length gloves.

Follow these guidelines to ensure arm and hand safety:

- Inspect and test new gloves for defects;
- Always wash your hands before and after using gloves,

- Wash chemical-protective gloves with soap and water before removing them;
- Do not wear gloves near moving machinery; the gloves may become caught;
- Do not wear gloves with metal parts near electrical equipment

!IMPORTANT!

Gloves are easily contaminated. Avoid touching surfaces such as telephones, door knobs, etc when wearing gloves.

B. Body Protection:

Hazards that threaten the torso tend to threaten the entire body. A variety of protective clothing, including laboratory coats, long pants, rubber aprons, coveralls, and disposable body suits are available for specific work conditions.

- Rubber, neoprene, and plastic clothing protect employees from most acids and chemical splashes.
- Laboratory coats, coveralls, and disposable body suits protect employees and everyday clothing from contamination.
- Welding aprons provide protection from sparks.
- Launder reusable protective clothing separate from other clothing

C. Ear and Hearing Protection:

If you work in a high noise area, wear hearing protection. Most hearing protection devices have an assigned rating that indicates the amount of protection provided.

Depending on your level of exposure, you may choose from the following devices:

- Disposable earplugs;
- Reusable earplugs;
- Headband plugs;
- Sealed earmuffs.

Earplugs may be better in hot, humid, or confined work areas. They may also be better for employees who wear other PPE, such as safety glasses or hats. Earmuffs, on the other hand, may be better for employees who move in and out of noisy areas, because the muffs are easier to remove. Before resorting to hearing protection, attempt to control noise levels through engineering or operational changes.

To avoid contamination, follow these guidelines when using earplugs:

- Wash your hands before inserting earplugs;
- Replace disposable earplugs after each use;

- Clean reusable earplugs after each use.

Refer to the Hearing Conservation Program in the General Safety chapter or contact the Emergency Manager for more information.

D. Eye and Face Protection:

Employees must wear protection if hazards exist that could cause eye or face Injury. Eye and face protection should be used in conjunction with equipment guards, engineering controls, and safe practices.

NOTE:

Safety glasses are required in laboratories. Always wear adequate eye and face protection when performing tasks such as grinding, buffing, welding, chipping, cutting, or pouring chemicals. Safety glasses with side shields provide protection against impact and splashes, but safety goggles provide protection against impact, splashes, and hazardous atmospheres.

!IMPORTANT!

Do not wear contact lenses in the laboratory or other areas where hazardous atmospheres may be present. Contact lenses do not provide eye protection and may reduce the effectiveness of an emergency eyewash.

If you wear prescription glasses, wear goggles or other safety protection over the glasses.

Safety glasses with sideshields provide primary protection to eyes and are four times as resistant as prescription glasses to impact injuries.

Goggles protect against impacts, sparks, chemical splashes, dust, and irritating mist. Wear full goggles, not just safety glasses, when working with chemicals

Eyecup welding goggles with filter lenses give protection from glare and sparks.

A welding helmet protects from flashburn due to welding, soldering, or brazing, but does not provide primary eye protection; safety glasses or goggles should be worn with the helmet.

A face shield is designed to protect the face from some splashes or projectiles, but does not eliminate exposure to vapors. A face shield should be worn with goggles or safety glasses.

Sunglasses are useful to prevent eyestrain from glare and to minimize ultraviolet light exposure.

E. Eye Wash Stations:

Eye wash stations provide emergency eye treatment for people exposed to hazardous materials.

There are three common types of eye wash stations:

1. Eye Wash Bowls:

These stations are ANSI approved and are usually attached to emergency showers. They provide a continuous water flow and are recommended for laboratories and other locations with hazardous materials.

2. Drench Hoses at Sinks:

These stations provide a continuous water flow, but they are easily contaminated with sediment, and they do not allow the free use of both hands; the use of both hands may be necessary. Drench hoses are not ANSI approved, and they are not preferred for laboratory usage. If you have a drench hose in your work area, flush the hose regularly to remove any sediment.

3. Plastic Eye Wash Bottles:

These stations do not provide a continuous water flow, and they do not allow free use of both hands. They are not approved in laboratories or other hazardous areas. Plastic eye wash bottles are ideal, however, for portable eye wash needs and short-term operations where continuous flowing water is not immediately available. If you have a plastic eye wash bottle in your work area, make sure it is filled with sterile water or changed weekly.

!IMPORTANT!

If the eyes are exposed to hazardous materials or irritating elements, immediately flush the eyes with water for at least 15 minutes. Contact a physician, if necessary. The area around eyewash stations shall be clear of all obstructions to allow unimpeded access.

F. Foot Protection:

To protect feet and legs from falling objects, moving machinery, sharp objects, hot materials, chemicals, or slippery surfaces, employees should wear closed-toed shoes, boots, footguards, leggings, or safety shoes as appropriate. Safety shoes are designed to protect people from the most common causes of foot injuries — impact, compression, and puncture. Special foot protection is also available for protection against static electricity, sparks, live electricity, corrosive materials, and slipping.

NOTE:

Foot protection is particularly important in laboratory, and construction work.

!IMPORTANT!

Do not wear sandals or open-toed shoes in laboratories, shops, or other potentially hazardous areas.

G. Head Protection:

Accidents that cause head injuries are difficult to anticipate or control. If hazards exist that could cause head injury, employees should try to eliminate the hazards, but they should also wear head protection. Safety hats protect the head from impact, penetration, and electrical shock. Head protection is necessary if you work where there is a risk of injury from moving, falling, or flying objects or if you work near high-voltage equipment. Hard hats should be water resistant, flame resistant, and adjustable. Wear one of the following hard hats as appropriate for your work situation:

- Class A - General service, limited voltage protection ;
- Class B - Utility service, high-voltage protection;
- Class C - Special service, no voltage protection

Follow these guidelines for head safety:

- Check the shell and suspension of your headware for damage before each use;
- Look for cracks, dents, gouges, chalky appearance, and torn or broken suspension threads;
- Discard damaged hats or replace broken parts with replacements from the original manufacturer;
- Discard any hat that has been struck or dropped from a great height, even if there is no apparent damage;
- Do not wear a hard hat backwards, unless this is necessary to accommodate other protective equipment (eg, welders face shield);
- Do not paint the plastic shell of a hard hat or alter it in any way.

H. Respiratory Protection Program:

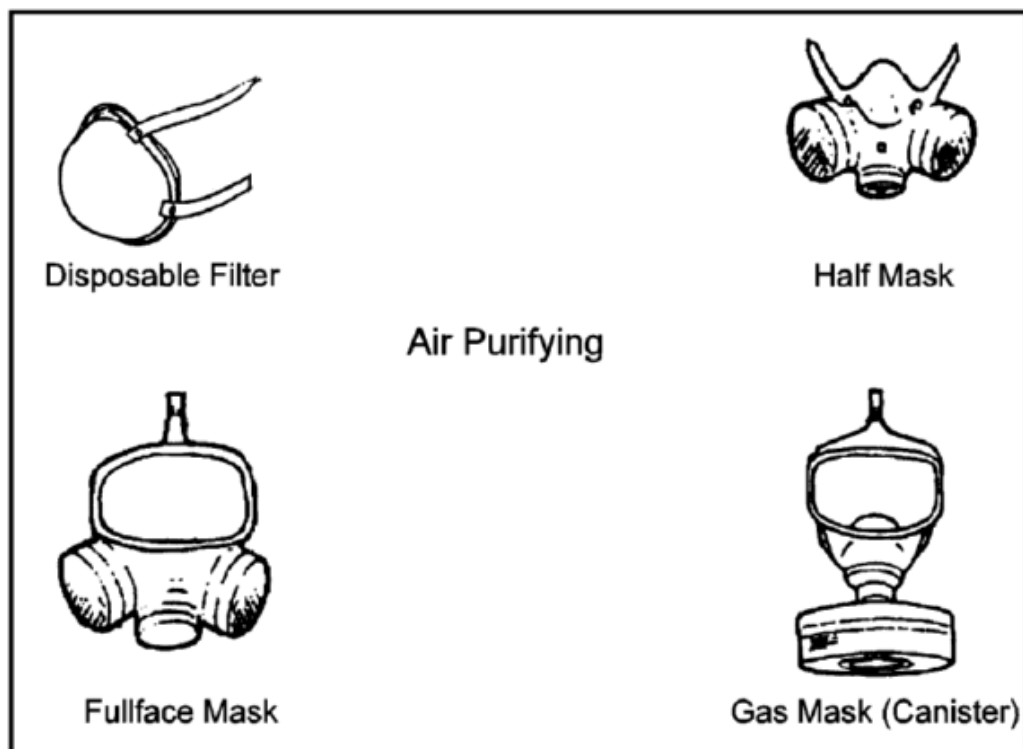
Amarillo College uses engineering, administrative, and procedural controls to protect people from dangerous atmospheres, including harmful mists, smoke, vapors, and oxygen-deficient atmospheres. When these controls cannot provide adequate protection against harmful atmospheres, respiratory protection is necessary.

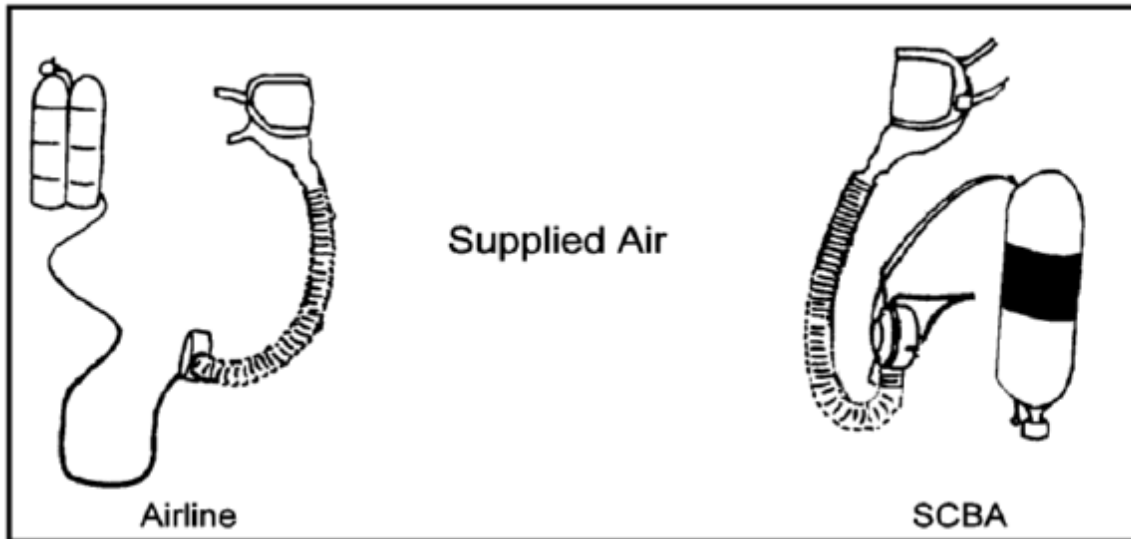
The Physical Plant can provide training and fit testing for personnel who need respiratory protection . A copy of the Respiratory Protective Program is available from the Physical Plant.

1. Usage Requirements:

People who use respiratory protection must be physically capable of using and wearing the equipment. In some cases, a physician must determine if an employee is healthy enough to use a respirator. In addition, all people required to wear respirators must be formally trained and instructed in proper equipment usage. This training should include instruction on common respiratory hazards and symptoms of exposure.

2. Types of Respirators:





It is important to select the right respirator for the job. There are many types of respirators and each type protects against different hazards. Respirators are classified according to these factors:

- Air source: supplied air or ambient air;
- Pressure: positive or negative;
- Mask configuration.

The following lists information on various respirators:

Supply Air Respirators:

- Self-Contained Breathing Apparatus (SCBAs) use supplied air from a cylinder carried by the user;
- Airline respirators require a compressor or cylinder(s) and an airline hose to the user;
- Supply air respirators are necessary in oxygen deficient atmospheres;
- When using a supply air respirator, have a back-up person with a SCBA standing nearby.

Air-Purifying Respirators:

- Air purifying respirators use ambient air and cannot be used in oxygen deficient atmospheres, IDLH atmospheres, or areas where the identity or concentration of a contaminant is unknown;
 - Ambient air is purified by a chemical cartridge, canister, or particulate filter;
 - Users must select the proper cartridge/canister/filter;

- Cartridges and canisters must be replaced if the user notices an odor, taste, or throat irritation Wet, damaged, and grossly contaminated cartridges/canisters must also be replaced;
- Powered air- purifying respirators use filtered ambient air in a positive-pressure continuous flow mode;
- Disposable or single-use respirators are made of cloth or paper and are primarily used for nuisance dusts;
- All filters (HEPA, dust pads, and disposable respirators) must be replaced if any of the following conditions occur:
Breathing becomes difficult,
Filter or dust respirator becomes damaged, visibly dirty, wet, or contaminated on the inside.

Mask Types:

- Full face mask covers the face from the hairline to below the chin, This type of mask provides eye protection,
- Half-face mask covers the face from above the nose to below the chin.

The following table highlights various respirators and their ability to protect against different hazards:

RESPIRATOR TYPE	PROTECTION	NO PROTECTION
Filter Respirator (HEPA cartridge)	Dust Fumes Smoke Mist Microorganisms Asbestos	Chemical vapors or gases Oxygen deficiency
Chemical Cartridge/Canister Respirators	Certain gases and vapors up to a particular Concentration	Oxygen deficiency Particulate matter
Air Supply Respirator	Depending on type: Particulates Chemical vapors and gases Oxygen deficiency	

NOTE:

Only use respirators that are approved by NIOSH/MSHA or the Department of Interior-Bureau of Mines.

3. Selecting a Respirator:

When selecting a respirator, consider the following factors:

- Type of hazards;
- Identity and concentration of the contaminant;
- Time constraints;
- Activity of the person wearing the respirator;
- Degree of protection provided by each type of respirator.

Follow these guidelines for selecting the correct respirator:

Use a HEPA filtered respirator:

- If the contaminant is a biological hazard

Use a supply air respirator:

- If the identity and/or concentration of the contaminant is not known;
- If an oxygen deficient atmosphere is known or suspected;
- If an IDLH condition exists.

Use a SCBA instead of an airline respirator:

- If an airline respirator could be damaged by work or conditions within the area.

!IMPORTANT!

Respirators are available in different sizes. Always fit test a respirator to select the correct size.

4. Using Respirators Safely:

Follow these guidelines to ensure safe respirator usage:

- Make sure you have the correct respirator for the job;
- Inspect respirators before each use;
- Shave facial hair and put in dentures (if applicable) to ensure a good seal with the facemask;
- If you are working in a dangerous area, have another person present;
- Remember that contaminants can harm the body as well as the respiratory tract; wear protective clothing as appropriate.

Return to fresh air and remove the respirator in the following conditions:

- You feel nauseous, dizzy, or ill;
- You have difficulty breathing;
- The canister, cartridge, or filter needs to be replaced;
- Properly clean and store all reusable respirators.

In addition to the guidelines above, follow these instructions for respirator usage:

- Do not use a respirator unless you have been formally trained and have fit tested the respirator you plan on using;
- Do not mistakenly use a filter respirator for protection against gases or vapors;
- Never remove a respirator in a contaminated atmosphere;
- Do not talk unnecessarily or chew gum while wearing a respirator;
- Do not wear contact lenses while wearing a respirator;
- Do not allow your hair or eyeglass frames to interfere with the face mask seal.

I. Showers:

Emergency safety showers provide emergency treatment for people exposed to harmful materials. If a person is contaminated with harmful chemicals, the emergency shower provides an instant deluge to protect the person from further exposure. Amarillo College uses ANSI standards for shower locations, travel distance, testing, and function. Emergency showers must be located to ensure accessibility within 10 seconds. Travel distance between a shower and potential hazards may not exceed 100 feet.

!IMPORTANT!

Emergency showers are for emergencies only. If a chemical spill occurs involving personal exposure, pull the cord and remove affected clothing immediately. Stay in the shower for at least 15 minutes.

Physical Plant tests emergency showers located in the numerous laboratories on a regular basis.

X. Laboratory Safety:

Because laboratories involve numerous chemicals, procedures, and operations, they require extensive safety precautions. Laboratory safety involves chemical safety, fire safety, electrical safety, and other safety issues. Follow the guidelines in this chapter for general laboratory safety, but refer to other chapters in this manual for specific information.

This section discusses the following:

- Common laboratory hazards;
- Controlling laboratory risks;
- Safe laboratory practices;
- Equipment safety.

A. Common Laboratory Hazards:

Examples of common hazards include the following:

- Chemical hazards:
 - Toxins, corrosives, flammables, and reactives;
- Biological hazards:
 - Microbes, animals, plants, and genetically modified agents;
- Radiation hazards:
 - Ionizing and non-ionizing radiation;
- Physical hazards:
 - Heating devices, noise, projectiles, fire, cold, etc;
- Electrical hazards:
 - Fire and shock;
- Mechanical hazards:
 - Moving machinery;
- Airborne hazardous materials:
 - Vapors, dust, etc;
- Ergonomic factors:
 - Standing, repetitive motion.

B. Controlling Laboratory Risks:

Administrative and engineering controls can help minimize laboratory risks. However, safety conscious workers using good laboratory practices are the most important component of laboratory safety.

The following factors are important for safe laboratory operations:

Adequate physical facilities:

- Proper ventilation;
- Nonslip surfaces;
- Hand washing Physical Plant.

Available and appropriate safety equipment:

- Personal protective equipment;
- Laboratory equipment;
- Safety devices on laboratory equipment, machines, devices, and Instruments.

Appropriate emergency equipment:

- Fire extinguishers;
- Emergency showers;
- Eye wash stations.

Appropriate procedures:

- Good housekeeping;
- Personal hygiene (eg, washing hands).

Knowledgeable workers:

- Experienced;
- Trained.

All laboratory doors should be labeled with emergency contact information. If an incident occurs during off-hours, respondents need to know the names and telephone numbers of the people responsible for laboratory operations. Keep this information current and accurate. Emergency contact labels are available from the Physical Plant.

Properly trained and experienced workers have the greatest ability to control laboratory risks. By using good laboratory practices, workers can minimize hazards, exposure, contamination, and workplace accidents.

C. Safe Laboratory Practices:

To ensure laboratory safety, follow safe laboratory practices, including the following:

- Know about the chemicals and hazards associated with your laboratory;
- Know what to do in different emergency situations;
- Know how to read and interpret MSDSs;
- Wear personal protective equipment, as appropriate;
- Follow safe practices for working with chemicals (Refer to the Chemical Safety chapter for more information);
- Ice from a laboratory ice machine should not be used for human consumption;
- Dedicate microwave ovens and other heating devices exclusively for food or for laboratory operations. Ensure that ovens are clearly labeled to indicate their function.
- Do not wear contact lenses around chemicals, fumes, dust particles, or other hazardous materials.
- Protect unattended operations from utility failures and other potential problems that could lead to overheating or other hazardous events;
- Avoid working alone in a laboratory;
- Avoid producing aerosols;
- Use extreme care when working with needles, blades, and glass;
- Do not eat, drink, or use tobacco products in the laboratory;
- Do not mouth pipet;
- Clean contaminated equipment and spills immediately,

- Avoid contaminating equipment with mercury,
- Clean mercury spills immediately (Chronic exposure to mercury can result from a few drops left uncleaned);
- Do not allow children in the laboratory (It is a violation of state law for a child to be unattended in a place that presents a risk of harm);
- Keep laboratory doors closed;
- Decontaminate all affected equipment;
- Avoid using dry ice in enclosed areas (Dry ice can produce elevated carbon dioxide levels);
- Dry ice mixed with isopropanol or ethanol may cause frostbite;
- Hallways, corridors, and exit ways must be kept clear;
- Do not locate (even temporarily) laboratory equipment or supplies in these areas.

¡IMPORTANT!

Never underestimate the hazards associated with a laboratory. If you are unsure about what you are doing, get assistance. Do not use unfamiliar chemicals, equipment, or procedures alone.

D. Equipment Safety:

There are four fundamental elements of equipment safety:

- (1) use the correct equipment,
- (2) know how to operate the equipment,
- (3) inspect the equipment, and
- (4) use the equipment properly.

Use equipment for its intended purpose only. Do not modify or adapt equipment without guidance from the equipment manufacturer or the Physical Plant. Do not defeat, remove, or override equipment safety devices. Working in a laboratory requires various types of equipment.

To ensure equipment safety, you must be familiar with the following:

- Equipment operation;
- Applicable safeguards;
- Maintenance requirements;
- Always inspect equipment before using it.

Ensure that the equipment meets the following requirements:

- Controls and safeguards are adequate and functional;
- Location is safe (and well ventilated, if necessary);
- Equipment works properly.

¡IMPORTANT!

Disconnect any equipment that is unsafe or does not work properly, and remove it from service. Notify other users of the problem. Refer to other sections in this manual for specific information on operating laboratory equipment, such as fume hoods, heating devices, vacuums, etc.

E. Aerosol Production:

The term "aerosol" refers to the physical state of liquid or solid particles suspended in air.

Aerosols containing infectious agents and hazardous materials can pose a serious risk because:

- Small aerosol particles can readily penetrate and remain deep in the respiratory tract, if inhaled;
- Aerosols may remain suspended in the air for long periods of time;
- Aerosol particles can easily contaminate equipment, ventilation systems, and human skin.

The following equipment may produce aerosols:

- Centrifuge;
- Blender;
- Shaker;
- Magnetic stirrer;
- Sonicator;
- Pipet;
- Vortex mixer;
- Syringe and needle;
- Vacuum-sealed ampoule;
- Grinder, mortar, and pestle
- Test tubes and culture tubes;
- Heated inoculating loop;
- Separatory funnel.

Follow these guidelines to eliminate or reduce the hazards associated with aerosols:

- Conduct procedures that may produce aerosols in a biological safety cabinet or a chemical fume hood;
- Keep tubes stoppered when vortexing or centrifuging;
- Allow aerosols to settle for one to five minutes before opening a centrifuge, blender, or tube;

- Place a cloth soaked with disinfectant over the work surface to kill any biohazardous agents;
- Slowly reconstitute or dilute the contents of an ampoule;
- When combining liquids, discharge the secondary material down the side of the container or as close to the surface of the primary liquid as possible;
- Avoid splattering by allowing inoculating loops or needles to cool before touching biological specimens;
- Use a mechanical pipetting device.

F. Animals:

Amarillo College does not use live animals for research or instructional use.

G. Centrifuges:

Centrifuging presents the possibility of two serious hazards: mechanical failure and aerosols. The most common hazard associated with centrifuging is a broken tube.

To ensure safety when operating a centrifuge, take precautions to ensure the following:

- Proper loading (accurate balancing);
- Safe operating speeds (do not exceed manufacturer recommendations);
- Safe stopping;
- Complete removal of materials;
- Proper cleanup.

Follow these guidelines when working with a centrifuge:

- When loading the rotor, examine the tubes for signs of stress, and discard any tubes that are damaged;
- Inspect the inside of each tube cavity or bucket. Remove any glass or other debris from the rubber cushion;
- Ensure that the centrifuge has adequate shielding to guard against accidental flyaways;
- Use a centrifuge only if it has a disconnect switch that deactivates the rotor when the lid is open;
- Do not overfill a centrifuge tube to the point where the rim, cap, or cotton plug becomes wet;
- Always keep the lid closed during operation and shut down,
 - Do not open the lid until the rotor is completely stopped;
- Do not brake the head rotation by hand;
- Do not use aluminum foil to cap a centrifuge tube. Foil may rupture or detach;
- When balancing the rotors, consider the tubes, buckets, adapters, inserts, and any added solution;

- Stop the rotor and discontinue operation if you notice anything abnormal such as a noise or vibration;
- Rotor heads, buckets, adapters, tubes, and plastic inserts must match;
- Low-speed and small portable centrifuges that do not have aerosol-tight chambers may allow aerosols to escape,
 - Use a safety bucket to prevent aerosols from escaping;
- High-speed centrifuges pose additional hazards due to the higher stress and force applied to their rotors and tubes.

In addition to the safety guidelines outlined above, follow these guidelines for high-speed centrifuges:

- Filter the air exhausted from the vacuum lines;
- Keep a record of rotor usage, in order to avoid the hazard of metal fatigue;
- Frequently inspect, clean, and dry rotors to prevent corrosion or other damage;
- Follow the manufacturer's operating instructions exactly.

H. Compressed Gases:

Compressed gases in the laboratory present chemical and physical hazards.

If compressed gases are accidentally released, they may cause the following:

- Depleted oxygen atmosphere;
- Fire;
- Adverse health effects.

Cylinders that are knocked over or dropped can be very dangerous and can cause serious injuries. If a valve is knocked off a compressed gas cylinder, the cylinder can become a lethal projectile. Because disposal of compressed gas cylinders is difficult and expensive, be sure to arrange a return agreement with suppliers prior to purchase.

!IMPORTANT!

Cylinders can travel through walls much like a torpedo travels through water. They can cause structural damage, severe injury, and death.

Follow these guidelines to ensure safe storage of gas cylinders:

- Secure all cylinders in racks, holders, or clamping devices,
 - Fasten cylinders individually (not ganged) in a well ventilated area;
- Do not rely on color to identify container contents Check the label;
- Close valves, and release pressure on the regulators when cylinders are not in use.

Minimize the number of hazardous gas cylinders in a laboratory.

Do not exceed the following:

- Three 10" x 50" flammable gas and/or oxygen cylinders, and
- Two 9" x 30" liquefied flammable gas cylinders, and
- Three 4" x 15" cylinders of severely toxic gases (eg, arsine, chlorine, diborane, fluorine, hydrogen cyanide, methyl bromide, nitric oxide, phosgene);
- Keep heat, sparks, flames, and electrical circuits away from gas cylinders;
- Store cylinders of flammable and oxidizing agents at least 20 feet apart, or separate these items with a fire wall;
- Do not store gas cylinders in hallways or public areas.

When working with compressed gas cylinders, remember the following:

- Never move a gas cylinder unless the cylinder cap is in place and the cylinder is chained or otherwise secured to a cart;
- Do not move a cylinder by rolling it on its base;
- Only use regulators approved for the type of gas in the cylinder;
- Do not use adapters to interchange regulators;

When opening a cylinder valve, follow these guidelines:

- Direct the cylinder opening away from people;
- Open the valve slowly;
- If a cylinder leaks, carefully move the cylinder to an open space outdoors,
 - Have the supplier pick up the cylinder;
- Do not use oil or other lubricant on valves and fittings;
- Do not use oxygen as a substitute for compressed air
- Do not lift cylinders by the cap;
- Do not tamper with the safety devices on a cylinder,
 - Have the manufacturer or supplier handle cylinder repairs;
- Do not change a cylinder's label or color;
- Do not refill cylinders yourself;
- Do not heat cylinders to raise internal pressure;
- Do not use compressed gas to clean your skin or clothing;
- Do not completely empty cylinders,
 - Maintain at least 30 psi;
- Do not use copper (>65% copper) connectors or tubing with acetylene,
 - Acetylene can form explosive compounds with silver, copper, and mercury;
- Always wear impact resistant glasses or goggles when working with compressed gases.

I. Cryogenic Liquids:

Cryogenic fluids, such as liquid air, liquid nitrogen, or liquid oxygen, are used to obtain extremely cold temperatures. Most cryogenic liquids are odorless, colorless, and tasteless when vaporized. When cryogenic liquids are exposed to the atmosphere, however, they create a highly visible and dense fog. All cryogens other than oxygen can displace breathable air and can cause asphyxiation. Cryogens can also cause frostbite on exposed skin and eye tissue.

Cryogens pose numerous hazards. For example, cryogenic vapors from liquid oxygen or liquid hydrogen may cause a fire or explosion if ignited. Materials that are normally noncombustible (eg, carbon steel) may ignite if coated with an oxygen-rich condensate. Liquefied inert gases, such as liquid nitrogen or liquid helium, are capable of condensing atmospheric oxygen and causing oxygen entrapment or enrichment in unsuspected areas. Extremely cold metal surfaces are also capable of entrapping atmospheric oxygen.

Additional hazards associated with cryogenic liquids include the following:

Cryogenic Hazard Source	Hazard
Hydrogen, methane, and acetylene	Gases are flammable
Oxygen	Increase the flammability of combustibles.
Liquefied inert gases	Possible oxygen entrapment.
Extremely cold surfaces	Oxygen atmosphere may condense.

Because the low temperatures of cryogenic liquids may affect material properties, take care to select equipment materials accordingly.

Follow these guidelines when working with cryogenic liquids:

- Before working with cryogenic liquids, acquire a thorough knowledge of cryogenic procedures, equipment operation, safety devices, material properties, and protective equipment usage;
- Keep equipment and systems extremely clean;
- Avoid skin and eye contact with cryogenic liquids,
 - Do not inhale cryogenic vapors;
- Pre-cool receiving vessels to avoid thermal shock and splashing;
- Use tongs to place and remove items in cryogenic liquid;
- When discharging cryogenic liquids, purge the line slowly,
 - Only use transfer lines specifically designed for cryogenic liquids;
- Rubber and plastic may become very brittle in extreme cold,
 - Handle these items carefully when removing them from cryogenic liquid;
- Store cryogenic liquids in double-walled, insulated containers (eg, Dewar flasks);
- To protect yourself from broken glass if the container breaks or implodes, tape the exposed glass on cryogenic containers;

- Do not store cylinders of cryogenic liquids in hallways or other public areas.

iIMPORTANT!

Be aware of the tremendous expansion and threat of asphyxiation when a cryogenic liquid vaporizes at room temperature.

J. Electrophoresis:

Electrophoresis equipment may be a major source of electrical hazard in the laboratory. The presence of high voltage and conductive fluid in this apparatus presents a potentially lethal combination. Many people are unaware of the hazards associated with this apparatus; even a standard electrophoresis operating at 100 volts can deliver a lethal shock at 25 milliamps. In addition, even a slight leak in the device tank can result in a serious shock.

Protect yourself from the hazards of electrophoresis and electrical shock by taking these precautions:

- Use physical barriers to prevent inadvertent contact with the apparatus;
- Use electrical interlocks;
- Frequently check the physical integrity of the electrophoresis equipment;
- Use warning signs to alert others of the potential electrical hazard;
- Use only insulated lead connectors;
- Turn the power off before connecting the electrical leads;
- Connect one lead at a time using one hand only;
- Ensure that your hands are dry when connecting the leads;
- Keep the apparatus away from water and water sources;
- Turn the power off before opening the lid or reaching into the chamber;
- Do not disable safety devices
- Follow the equipment operating instructions.

K. Glassware:

Accidents involving glassware are the leading cause of laboratory injuries. To reduce the chance of cuts or punctures, use common sense when working with glassware. In addition, follow special safety precautions for tasks that involve unusual risks.

Follow these practices for using laboratory glassware safely:

- Prevent damage to glassware during handling and storage;
- Inspect glassware before and after each use,
 - Discard or repair any cracked, broken, or damaged glassware;
- Thoroughly clean and decontaminate glassware after each use;

When inserting glass tubing into rubber stoppers, corks, or tubing, follow these guidelines:

- Use adequate hand protection;
- Lubricate the tubing;
- Hold hands close together to minimize movement if the glass breaks
- When possible, substitute plastic or metal connectors for glass connectors;
- Large glass containers are highly susceptible to thermal shock,
 - Heat and cool large glass containers slowly;
- Use Pyrex or heat-treated glass for heating operations;
- Leave at least 10 percent air space in containers with positive closures;
- Never use laboratory glassware to serve food or drinks;
- Use thick-walled glassware for vacuum operation ;
- Use round-bottomed glassware for vacuum operations,
 - Flat-bottomed glassware is not as strong as round-bottomed glassware.

NOTE:

Do not use chromic acid to clean glassware. Use a standard laboratory Detergent. Chromic acid is extremely corrosive and expensive to dispose of. Chromic acid must not be disposed in the sanitary sewer system.

Follow these safety guidelines for handling glassware:

- When handling cool flasks, grasp the neck with one hand and support the bottom with the other hand;
- Lift cool beakers by grasping the sides just below the rim,
 - For large beakers, use two hands: one on the side and one supporting the bottom ;
- Never carry bottles by their necks;
- Use a cart to transport large bottles of dense liquid.

Follow these guidelines for handling and disposing of broken glass:

- Do not pick up broken glass with bare or unprotected hands. Use a brush and dustpan to clean up broken glass. Remove broken glass in sinks by using tongs for large pieces and cotton held by tongs for small pieces and slivers;
- Glass contaminated with biological, chemical, or radioactive materials must be decontaminated before disposal or be disposed of as hazardous waste;
- Before disposing of broken glass in a trash can, place the glass in a rigid container such as cardboard and mark it "Broken Glass".

L. Heating Systems:

Devices that supply heat for reactions or separations include the following:

- Open flame burners;

- Hot plates;
- Heating mantles;
- Oil and air baths;
- Hot air guns;
- Ovens;
- Furnaces;
- Ashing systems.

Some laboratory heating procedures involve an open flame. Common hazards associated with laboratory heating devices include electrical hazards, fire hazards, and hot surfaces.

Follow these guidelines when using heating devices:

Before using any electrical heating device, follow these guidelines:

- Ensure that heating units have an automatic shutoff to protect against Overheating;
- Ensure that heating devices and all connecting components are in good working condition;
- Heated chemicals can cause more damage and more quickly than would the same chemicals at a lower temperature.

RULE OF THUMB:

Reaction rates double for each 10°C increase in temperature.

- Heating baths should be equipped with timers to ensure that they turn on and off at appropriate times;
- Use a chemical fume hood when heating flammable or combustible solvents;
- Arrange the equipment so that escaping vapors do not contact heated or sparking surfaces;
- Use non-asbestos thermal-heat resistant gloves to handle heated materials and equipment;
- Perchloric acid digestions must be conducted in a perchloric fume hood;
- Minimize the use of open flames.

!IMPORTANT!

Never leave an open flame unattended.

M. Pressurized Systems:

Do not conduct a reaction in, or apply heat to, a closed system apparatus unless the equipment is designed and tested to withstand pressure. Pressurized systems should have an appropriate relief valve.

Pressurized systems must be fully shielded and should not be conducted in an occupied space until safe operation has been assured. Until safe operation is assured, remote operation is mandatory .

Safety points to remember:

- Minimize risk and exposure;
- Identify and assess all hazards and consequences;
- Use remote manipulations whenever possible;
- Minimize pressure, volume, and temperature;
- Design conservatively;
- Use material with a predictably safe failure mode;
- Ensure that the components of the pressurized system will maintain structural integrity at the maximum allowable working pressure,
 - Avoid material that may become brittle;
- Operate within the original design parameters;
- Provide backup protection (eg, pressure relief valves, fail-safe devices);
- Use quality hardware;
- Use protective shield or enclosures;
- Use tie-downs to secure tubing and other equipment;
- Do not leave a pressurized system unattended.

!IMPORTANT!

Normally pressurized systems should not include glass components unless they are specially designed and intended for that purpose.

N. Refrigerators/ Freezers:

Using a household refrigerator to store laboratory chemicals is extremely hazardous for several reasons:

- Many flammable solvents are still volatile at refrigerator temperatures;
- Refrigerator temperatures are typically higher than the flashpoint of most flammable liquids;
- In addition, the storage compartment of a household refrigerator contains numerous ignition sources including:
 - thermostats, light switches, and heater strips,
 - Furthermore, the compressor and electrical circuits, located at the bottom of the unit where chemical vapors are likely to accumulate, are not sealed.

Laboratory-safe and explosion-proof refrigerators typically provide adequate protection for chemical storage in the laboratory. Laboratory-safe refrigerators, for example, are specifically designed for use with flammables since the sparking components are located on the exterior

of the refrigerator. Explosion-proof refrigerators are required in areas that may contain high levels of flammable vapors (eg, chemical storage rooms with large quantities of flammables).

Follow these rules for using refrigerators in the laboratory:

- Never store flammable chemicals in a household refrigerator;
- Do not store food or drink in a laboratory refrigerator/freezer;
- Ensure that all refrigerators are clearly labeled to indicate suitable usage;
- Laboratory-safe and explosion-proof refrigerators should be identified by a manufacturer's label;
- "Not Safe for Flammable Storage" labels are available from the Physical Plant;
- Refrigerators used to hold food should be labeled "For Food Only".

O. Vacuum Systems:

Vacuum systems pose severe implosion hazards.

Follow these guidelines and requirements to ensure system safety:

- Ensure that pumps have belt guards in place during operation;
- Ensure that service cords and switches are free from defects;
- Always use a trap on vacuum lines to prevent liquids from being drawn into the pump, house vacuum line, or water drain;
- Replace and properly dispose of vacuum pump oil that is contaminated with condensate,
 - Used pump oil must be disposed as hazardous waste;
- Place a pan under pumps to catch oil drips;
- Do not operate pumps near containers of flammable chemicals;
- Do not place pumps in an enclosed, unventilated cabinet.

!!IMPORTANT!!

All vacuum equipment is subject to possible implosion.

Conduct all vacuum operations behind a table shield or in a fume hood.

!!CAUTION!!

Do not underestimate the pressure differential across the walls of glassware that can be created by a water aspirator.

The glassware used with vacuum operations must meet the following requirements:

- Only heavy-walled round-bottomed glassware should be used for vacuum operations,
 - The only exception to this rule is glassware specifically designed for vacuum operations, such as an Erlenmeyer filtration flask;
- Wrap exposed glass with tape to prevent flying glass if an implosion occurs;
- Carefully inspect vacuum glassware before and after each use,

- Discard any glass that is chipped, scratched, broken, or otherwise stressed.

Glass desiccators often have a slight vacuum due to contents cooling.

When using desiccators, follow these guidelines:

- When possible, use molded plastic desiccators with high tensile strength;
- For glass desiccators, use a perforated metal desiccator guard.

P. Cold Trap:

A cold trap is a condensing device to prevent moisture contamination in a vacuum line.

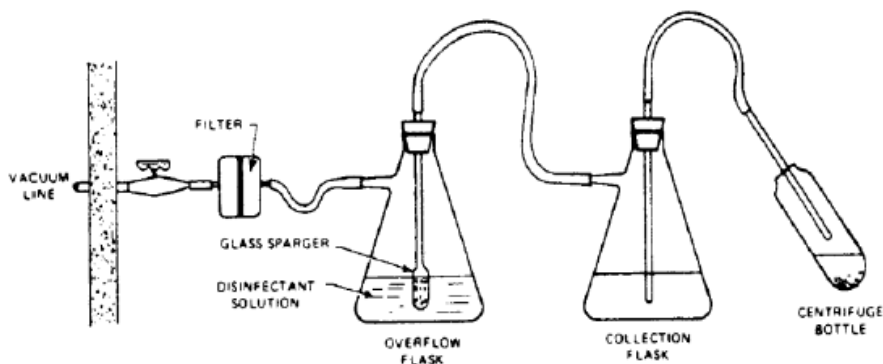
Guidelines for using a cold trap include:

- Locate the cold trap between the system and vacuum pump;
- Ensure that the cold trap is of sufficient size and cold enough to condense vapors present in the system;
- Check frequently for blockages in the cold trap;
- Use isopropanol/dry ice or ethanol/dry ice instead of acetone/dry ice to create a cold trap. Isopropanol and ethanol are cheaper, less toxic, and less prone to foam;
- Do not use dry ice or liquefied gas refrigerant bath as a closed system,
 - These can create uncontrolled and dangerously high pressures.

Q. Disinfectant Trap:

A disinfectant trap should be used in-line when a vacuum is used with hazardous biological materials.

The diagram below illustrates a suitable disinfectant trap assembly:



XI. Biological Safety:

The primary principle of biological safety (ie, biosafety) is containment. The term

containment refers to a series of safe methods for managing infectious agents in the laboratory. The purpose of containment is to reduce or eliminate human and environmental exposure to potentially harmful agents.

A. Primary and Secondary Containment:

There are two levels of biological containment — primary and secondary

1. Primary containment protects people and the immediate laboratory environment from exposure to infectious agents. Good microbial techniques and safety equipment provide sufficient primary containment. Examples of primary barriers include safety equipment such as biological safety cabinets, enclosed containers, and safety centrifuge cups. Occasionally, when it is impractical to work in biological safety cabinets, personal protective equipment, such as lab coats and gloves may act as the primary barrier between personnel and infectious materials.
2. Secondary containment protects the environment external to the laboratory from exposure to infectious materials. Good facility design and operational practices provide secondary containment. Examples of secondary barriers include work areas that are separate from public areas, decontamination facilities, hand washing facilities, special ventilation systems, and airlocks.
3. Elements of Containment: Ultimately, the three key elements of biological containment are:
 - laboratory practices,
 - safety equipment, and
 - facility design.

To ensure minimal exposure, employees must assess the hazards associated with their work and determine how to apply the biosafety principle appropriately

!IMPORTANT!

Employees working with infectious agents or potentially infectious materials must be aware of the hazards associated with their work.

These workers must be trained and proficient in biosafety procedures and techniques.

B. General Biosafety Guidelines:

Biohazardous materials require special safety precautions and procedures.

Follow these guidelines when working with infectious agents:

1. Personal Hygiene Guidelines:

- Wash your hands thoroughly, as indicated below:
 - After working with any biohazard;
 - After removing gloves, laboratory coat, and other contaminated protective clothing ;
 - Before eating, drinking, smoking, or applying cosmetics;
 - Before leaving the laboratory area.
- Do not touch your face when handling biological material;
- Never eat, drink, smoke, or apply cosmetics in the work area.

2. Clothing Guidelines:

- Always wear a wrap-around gown or scrub suit, gloves, and a surgical mask when working with infectious agents or infected animals;
- Wear gloves over gown cuffs;
- Never wear contact lenses around infectious agents;
- Do not wear potentially contaminated clothing outside the laboratory area;

To remove contaminated clothing, follow these steps:

- Remove booties from the back;
- Remove head covering from the peak;
- Untie gown while wearing gloves;
- Remove gloves by peeling them from the inside out;
- Remove the gown by slipping your finger under the sleeve cuff of the gown .

3. Handling Procedures:

- Use mechanical pipetting devices;
- Minimize aerosol production;
- Add disinfectant to water baths for infectious substances;
- Use trunnion cups with screw caps for centrifuging procedures,
 - Inspect the tubes before use;
- Use secondary leak-proof containers when transporting samples, cultures, inoculated petri dishes, and other containers of biohazardous materials.

4. Syringes:

- Avoid using syringes and needles whenever possible,

If a syringe is necessary, minimize your chances of exposure by following these guidelines:

- Use a needle-locking or disposable needle unit;
- Take care not to stick yourself with a used needle;
- Place used syringes into a pan of disinfectant without removing the needles;
- Do not place used syringes in pans containing pipets or other glassware that require sorting;
- Do not recap used needles;
- Dispose of needles in an approved sharps container.

5. Work Area:

- Keep laboratory doors shut when experiments are in progress;
- Limit access to laboratory areas when experiments involve biohazardous agents;
- Ensure that warning signs are posted on laboratory doors,
 - These signs should include the universal biohazard symbol and the approved biosafety level for the laboratory;
- Ensure that vacuum lines have a suitable filter trap;
- Decontaminate work surfaces daily and after each spill;
- Decontaminate all potentially contaminated equipment;
- Transport contaminated materials in leak-proof containers;
- Keep miscellaneous material (ie, books, journals, etc) away from contaminated areas;
- Completely decontaminate equipment before having maintenance or repair work done.

6. Universal Precautions:

Clinical and diagnostic laboratories often handle specimens without full knowledge of the material's diagnosis; these specimens may contain infectious agents. To minimize exposure, observe universal precautions when handling any biological specimen. Consider all specimens to be infectious and treat these materials as potentially hazardous.

C. CDC and NIH Biosafety Levels:

The Centers for Disease Control (CDC) and the National Institutes of Health (NIH) have established four biosafety levels consisting of recommended laboratory practices, safety equipment, and facilities for various types of infectious agents.

Each biosafety level accounts for the following:

- Operations to be performed;
- Known and suspected routes of transmission;
- Laboratory function.

1. Biosafety Level 1:

Biosafety Level 1 precautions are appropriate for facilities that work with defined and characterized strains of viable organisms that do not cause disease in healthy adult humans (eg, *Bacillus subtilis* and *Naegleria gruberi*).

Level 1 precautions rely on standard microbial practices without special primary or secondary barriers. Biosafety Level 1 criteria are suitable for undergraduate and secondary education laboratories.

2. Biosafety Level 2:

Biosafety Level 2 precautions are appropriate for facilities that work with a broad range of indigenous moderate-risk agents known to cause human disease (eg, Hepatitis B virus, salmonellae, and *Toxoplasma* spp).

Level 2 precautions are necessary when working with human blood, body fluids, or tissues where the presence of an infectious agent is unknown. The primary hazards associated with level 2 agents are injection and ingestion. Designated Amarillo College laboratories should comply with Biosafety Level 2 criteria.

3. Biosafety Level 3:

Biosafety Level 3 precautions apply to facilities that work with indigenous or exotic agents with the potential for aerosol transmission and lethal infection (eg, *Mycobacterium tuberculosis*). The primary hazards associated with level 3 agents are autoinoculation, ingestion, and inhalation. Level 3 precautions emphasize primary and secondary barriers.

- For primary protection, all laboratory manipulations should be performed in biological safety cabinet or other enclosed equipment.
- Secondary protection should include controlled access to the laboratory and a specialized ventilation system.

4. Biosafety Level 4:

Biosafety Level 4 precautions are essential for facilities that work with dangerous and exotic agents with a high risk of causing life-threatening disease, the possibility of aerosol transmission, and no known vaccine or therapy (eg, Marburg or Congo-Crimean viruses). Level 4 agents require complete isolation. Class III biological safety cabinets or full-body air-supplied positive-pressure safety suits are necessary when working with level 4 agents. In addition, isolated facilities, specialized ventilation, and waste management systems are required. There are no Biosafety Level 4 facilities at Amarillo College.

5. Animal Biosafety:

Four biosafety levels are also described for infectious disease work with laboratory animals. Animal Biosafety Levels 1, 2, 3, and 4 designate safety practices, equipment, and facilities. Refer to the Laboratory Safety chapter for more information regarding the use of hazardous materials with laboratory animals.

D. Disinfection and Sterilization:

Biological safety depends on proper cleanup and removal of potentially harmful agents. Disinfection and sterilization are two ways to help ensure biological safety in the laboratory.

Disinfection:

- Reduction of the number of pathogenic organisms by the direct application of physical or chemical agents.

Sterilization:

- Total destruction of all living organisms.

The following sections discuss guidelines and procedures for biological disinfection and sterilization:

1. General Guidelines:

- Choosing the best method for disinfection and sterilization is very important. The proper method depends on the following:
 - Target organisms to be removed;
 - Characteristics of the area to be cleaned.
- Once you have chosen the proper method for disinfection or sterilization, follow these guidelines to ensure laboratory safety:
 - Frequently disinfect all floors, cabinet tops, and equipment where biohazardous materials are used;
 - Use autoclavable or disposable materials whenever possible;
 - Keep reusable and disposable items separate;
 - Minimize the amount of materials and equipment present when working with infectious agents.
- Sterilize or properly store all biohazardous materials at the end of each day.

- Remember that some materials may interfere with chemical disinfectants— use higher concentrations or longer contact time;
- Use indicators with autoclave loads to ensure sterilization;
- Clearly mark all containers for biological materials (eg, BIOHAZARDOUS - TO BE AUTOCLAVED).

2. Types of Disinfectant:

Use the following table to aid in the selection of disinfectants:

Disinfectant	Uses
Alcohols	Ethyl or isopropyl alcohol at 70-80% concentration is a good general purpose disinfectant; not effective against bacterial spores.
Phenols	Effective against vegetative bacteria, fungi, and viruses containing lipids; unpleasant odor.
Formaldehyde	Concentration of 5-8% formalin is a good disinfectant against vegetative bacteria, spores, and viruses; known carcinogen; irritating odor.
Quaternary Ammonium Compounds	Cationic detergents are strongly surface active; extremely effective against lipoviruses; ineffective against bacterial spores; may be neutralized by anionic detergents (i.e., soaps).
Chlorine	Low concentrations (50-500 ppm) are active against vegetative bacteria and most viruses; higher concentrations (2,500 ppm) are required for bacterial spores; corrosive to metal surfaces; must be prepared fresh; laundry bleach (5.25% chlorine) may be diluted and used as a disinfectant.
Iodine	Recommended for general use; effective against vegetative bacteria and viruses; less effective against bacterial spores; Wescodyne diluted 1 to 10 is a popular disinfectant for washing hands.

NOTE:

See the Radiation Safety chapter for information pertaining to the use of ultraviolet lights as a method of disinfection.

3. Sterilization Methods:

There are three common methods for sterilizing laboratory materials:

- wet heat, dry heat, and ethylene oxide gas

a) Wet Heat:

When used properly, the damp steam heat from an autoclave effectively sterilizes biohazardous waste. Sterilization occurs when contaminated materials reach 15 psi pressure at 250°F or 121°C for at least 30 minutes.

!IMPORTANT!

For the autoclave process to be effective, sufficient temperature, time, and direct steam contact are essential.

Every Amarillo College department that autoclaves biohazardous waste should have written documentation to ensure the waste is sterile. Parameters for sterilization and standard operating procedures should include requirements for verifying sterilization.

Potential problems with wet heat sterilization and autoclaves include the following:

- Heavy or dense loads require higher temperature for sterilization;
- Poor heat conductors (eg, plastic) take longer to sterilize;
- Containers may prevent steam from reaching the materials to be sterilized;
- Incomplete air removal from the chamber can prevent contact between the steam and the load;
- Deep trays can interfere with air removal;
- Tightly stacked loads can impede steam circulation and air removal;
- Double-bagging will impede steam penetration;
- Carcasses do not allow steam penetration;
- Some bags and containers rated as autoclavable have thermal stability but they do not allow steam penetration.

To ensure that all materials are sterile, always test autoclave loads. Remember, that some sterilization indicators are incomplete. Autoclave tape, for example, verifies sufficient external temperature exposure, but it does not indicate internal equipment temperature, exposure time, or steam penetration .

Thermocouples or other instrumentation can also indicate temperature, but they do not verify sterility. A biological indicator is the most effective monitor to ensure sterility. Commercially available strips or vials of *Bacillus* species endospores, for example, are suitable biological indicators.

b). Dry Heat:

Dry heat is less effective than wet heat for sterilizing biohazardous materials. Dry heat requires more time (two to four hours) and a higher temperature (320–338°F or 160–170°C) to achieve sterilization. A *Bacillus* species biological indicator can verify dry heat sterilization.

c). Ethylene Oxide Gas:

Ethylene oxide gas is lethal to all microorganisms. Because it is also a known carcinogen and potentially explosive (freon and carbon dioxide mixtures are stable), minimize your exposure and use extreme care when working with this gas. Ethylene oxide sterilizers and aerators must be properly vented. Ethylene oxide gas is most effective with heat-resistant organisms and heat sensitive equipment.

The effectiveness of ethylene oxide gas may be affected by the following:

- Temperature:
 - The antimicrobial activity of ethylene oxide increases with increased temperature, Normal sterilization temperature is 120–140°F or 49–60°C ;
- Ethylene Oxide Concentration:
 - Sterilization time decreases with increased gas concentration, Normal concentration is 500-1000 mg/L;
- Humidity:
 - Relative humidity of 30-60% is necessary;
- Exposure Time:
 - Follow the manufacturer's recommendations.

E. Biological Safety Cabinets:

A biological safety cabinet is a primary barrier against biohazardous or infectious agents. Although biological safety cabinets surround the immediate workspace involving an agent, they do not provide complete containment (ie, aerosols can escape). Therefore, careful work practices are essential when working with agents that require a biological safety cabinet.

NOTE:

A biological safety cabinet is often referred to by other names such as: biohood, tissue culture hood, or biological fume hood.

All biological safety cabinets contain at least one High Efficiency Particulate Air (HEPA) filter. These cabinets operate with a laminar air flow (ie, the air flows with uniform velocity, in one direction, along parallel flow lines).

Biological safety cabinets must be inspected and certified:

- When newly installed;
- After filter or motor replacement;
- After being moved;
- Annually.

Contact the Physical Plant for more information about inspections:

1. Types of Cabinets:

The following sections discuss safety procedures and guidelines for working with various types of biological safety cabinets:

Type of Cabinet	Operation and Use
Class I	Only exhaust air is filtered. The user and environment are protected but the experiment is not. Operator's hands and arms may be exposed to hazardous materials inside the cabinet. This cabinet may be used with low to moderate-risk biological agents.
Class II:	Vertical laminar air flow with filtered supply and exhaust air. The user, product, and environment are protected.
Type A	Recirculates 70% of the air inside the cabinet. Do not use with flammable, radioactive, carcinogenic, or high-risk biological agents.
Type B1	Recirculates 30% of the air inside the cabinet and exhausts the rest to the outside. May be used with low to moderate-risk agents and small amounts of chemical carcinogens or volatiles.
Type B2	Offers total exhaust with no recirculation.
Type B3	Same as Class II Type A, but vented to the outside of the building.
Class III or Glove box	Gas-tight and maintained under negative air pressure. Used to work with highly infectious, carcinogenic, or hazardous materials. All operations are conducted through rubber gloves attached to entry portals.

2. Using Biological Safety Cabinets:

Follow these guidelines for using biological safety cabinets properly:

a) Preparation:

- Leave safety cabinets on at all times,
 - Otherwise, turn the blower on and purge the air for at least five minutes before beginning work;

- Never turn off the blower of a biological safety cabinet that is vented to the outside;
- Turn off the UV light if it is on;
- Never work in a unit with the UV light illuminated (UV light will damage your eyes);
- Do not depend on the UV germicidal lamp to provide a sterile work surface; wipe down the surface with a disinfectant (70% alcohol is usually suitable).

NOTE:

For more information on ultraviolet lights, refer to the Radiation Safety chapter.

- Place everything needed for your procedure inside the cabinet prior to beginning work,
 - Arrange the equipment in logical order
- Provide a container for wastes inside the cabinet (Remember, nothing should pass through the air barrier until the entire procedure is complete);
- Never place any items on the air-intake grilles;
- Place a disinfectant-soaked towel on the work surface to contain any splatters or spills that occur;
- Keep the laboratory door shut and post signs stating: **"CABINET IN USE"** on all the doors;
- Restrict activities that will disturb the cabinet's airflow, such as entry, egress, and walking traffic.

3. Cabinet Use:

- Conduct work at least four inches from the glass view panel,
 - The middle third area is ideal;
- Limit arm movement and avoid motions that could disturb airflow;
- If a burner is necessary, use the Touch-O-Matic type with a pilot light,
 - Since flames cause air turbulence, place burners to the rear of the workspace;
- Never use flammable solvents in a biological safety cabinet unless it is a total-exhaust cabinet (eg, Class II B2).

4. Experiment Completion:

- Enclose or decontaminate all equipment that has been in direct contact with the infectious agent;
- Cover all waste containers;
- To purge airborne contaminants from the work area, allow the cabinet to operate for five minutes with no activity inside the cabinet;
- Remove all equipment from the cabinet;

- Decontaminate interior work surfaces.

iIMPORTANT!

Biological safety cabinets are not a substitute for good laboratory practices. Because aerosols can escape, take precautions to minimize aerosol production and to protect you from contamination.

F. Clean Benches:

A clean bench has horizontal laminar air flow. The HEPA-filtered air flows across the work surface towards the operator, providing protection for the product, but no protection for the user. Because clean benches offer no protection, use a clean bench only to prepare sterile media. Do not use clean benches when working with pathogenic organisms, biological materials, chemicals, or radioactive materials.

G. Importing and Shipping Biological Materials:

The Public Health Service provides Foreign Quarantine regulations for importing etiologic agents and human disease vectors. Other regulations for packaging, labeling, and shipping, are administered jointly by the Public Health Service and the Department of Transportation. The US Department of Agriculture regulates the importation and shipment of animal pathogens. It prohibits the importation, possession, and use of certain animal disease agents that pose a serious threat to domestic livestock and poultry.

H. Biological Spill Response:

The exact procedure for responding to a biological spill depends on the material, amount, and location of the spill.

In general, follow these steps immediately after a biological spill occurs:

- Warn others;
- Leave the room; close the door;
- Remove contaminated garments;
- Wash your hands;
- Notify your supervisor.

Follow these steps to clean up a biological spill:

- Wait for any aerosols to settle;
- Put on protective clothing, as appropriate;
- Apply disinfectant to the contaminated area;
- Cover the area with paper towels to absorb the disinfectant;
- Wipe up the towels and mop the floor;

- Autoclave all contaminated wastes.

NOTE:

Spill cleanup must be appropriate for the hazards involved.

Call the, Emergency Manager for assistance if the spilled material is radioactive.

If a spill occurs inside a biological safety cabinet, follow these steps:

- Decontaminate materials while the cabinet is operating to prevent contaminants from escaping;
- Spray or wipe all affected equipment with an appropriate disinfectant (Wear gloves while doing this);
- If the spill is large, flood the work surface with disinfectant and allow it to stand for 10 to 15 minutes before removing it.

I. Biological Waste Disposal:

The Texas Department of State Health Services (TDSHS) and the Texas Commission on Environmental Quality (TCEQ) regulate the disposal of biohazardous waste. Waste that contains infectious materials and waste that may be harmful to humans, animals, plants, or the environment is considered biohazardous.

Examples of biohazardous waste include the following:

- Waste from infectious animals;
- Bulk human blood or blood products;
- Microbiological waste (including pathogen-contaminated disposable culture dishes, and disposable devices used to transfer, inoculate, and mix pathogenic cultures);
- Pathological waste;
- Sharps;
- Hazardous rDNA and genetic manipulation products.

Amarillo College's Waste Disposal Program (available from the Physical Plant) stipulates that biohazardous waste meets strict safety requirements for the following:

- Segregation;
- Treatment
- Labels;
- Packaging;
- Transportation;
- Documentation.

Biohazardous waste mixed with hazardous chemical or radioactive waste must be treated to eliminate the biohazard prior to disposal. After treatment, manage the hazardous waste through the Emergency Manager.

!IMPORTANT!

Disinfect all infectious material prior to disposal.

The following sections offer general safety guidelines and procedures for disposing of biological waste:

1. Segregation:

- Segregation is necessary when working with hazardous biological agents;
- Any waste that could cause a laceration or puncture must be disposed of as "Sharps",
 - Sharps must be segregated from other waste;
- Do not mix waste that requires incineration with glass or plastics;
- Do not mix biological waste with chemical waste or other laboratory Trash;
- Segregate hazardous biological waste from nonhazardous biological waste.

2. Handling and Transport:

Follow these guidelines for handling and transporting biohazardous waste:

- Properly trained personnel (not the custodial staff) are responsible for transporting treated biological waste to the dumpster or incinerator;
- Only properly trained technical personnel may handle untreated biohazardous waste;
- Contain and label all treated waste before transporting it to the incinerator or dumpster;
- Avoid transporting untreated biohazardous materials and foul or visually offensive materials through nonlaboratory areas;
- Do not use trash/laundry chutes, compactors, or grinders to transfer or process untreated biohazardous waste.

3. Labeling Biohazardous Waste:

Follow these guidelines for labeling biohazardous waste:

- Clearly label each container of untreated biohazardous waste and mark it with the Biohazard Symbol;
- Label containers intended for landfill disposal to indicate the method of treatment,

- Cover the Biohazard Symbol with this label;
- Label autoclave bags with special tape that produces the word "AUTOCLAVED" upon adequate thermal treatment,
 - Apply this tape across the Biohazard Symbol before autoclaving the bag;
- Label all containers for sharps as "ENCAPSULATED SHARPS";
- It is recommended to label nonhazardous biological waste as: **"NONHAZARDOUS BIOLOGICAL WASTE"**.

4. Disposal Methods:

Different materials require different disposal methods to ensure safety.

Follow these guidelines for physically disposing of biological waste:

a). Animal Carcasses and Body Parts:

- Incinerate the materials or send them to a commercial rendering plant for disposal.

Solid Animal Waste:

- All animal waste and bedding that is infectious or harmful to human, animals, or the environment should be treated by incineration, thermal disinfection, or chemical disinfection.

b). Liquid Waste:

- Liquid waste, including bulk blood and blood products, cultures and stocks of etiological agents and viruses, cell culture material, and rDNA products should be disinfected by thermal or chemical treatment and then discharged into the sanitary sewer system.

c). Metal Sharps:

- All materials that could cause cuts or punctures must be contained, encapsulated, and disposed of in a manner that does not endanger other workers.
- Needles, blades, etc are considered biohazardous even if they are sterile, capped, and in the original container.
- Pasteur Pipets and Broken Glassware:
 - Place in a rigid, puncture resistant container;
 - Disinfect by thermal or chemical treatment,

- If contaminated: Label the container as "Broken Glass" and place it in a dumpster.

NOTE:

If broken glass is commingled with metal sharps, encapsulation is required for disposal.

d). Plastic Waste:

- Contaminated materials must be thermally or chemically treated and placed in a properly labeled, leak-proof container for disposition in the dumpster;
- Materials that are not contaminated may be placed directly in the dumpster.

e). Microbiological Waste:

- Solids must be thermally or chemically treated and placed in a properly labeled, leak-proof container for disposition in the dumpster;
- Liquids must be thermally or chemically treated and then discharged into the sanitary sewer system.

f). Human Pathological Waste:

- Human cadavers and recognizable body parts must be cremated or buried;
- Other pathological waste from humans and primates must be incinerated.

g). Genetic Material:

- Materials containing rDNA or genetically altered organisms must be disposed of in accordance with NIH Guidelines and the Amarillo College Waste Disposal Program.

J. Nonhazardous Biological Waste

- Most biological waste that is not infectious or otherwise hazardous to humans, animals, plants, or the environment may be discarded as regular waste or sewage;
- The only exceptions are animal carcasses and body parts,
 - These wastes must be incinerated or sent to a commercial rendering plant for treatment;
- In addition, there are no record-keeping requirements for nonhazardous biological wastes.

Follow these guidelines for nonhazardous biological waste:

- It is recommended to autoclave or disinfect all microbial products, even if they are not biohazardous;
- Avoid disposing of waste in a manner that could cause visual or odorous Problems;
- Do not label nonhazardous biological waste as hazardous (eg, do not use the Biohazard Symbol, red bags, etc),
 - Instead, it is recommended to label the container as **"NONHAZARDOUS BIOLOGICAL WASTE"**;
- Use nonhazardous animal bedding and manure for compost or fertilizer when possible.

K. Recordkeeping Requirements

Each Amarillo College department that generates biohazardous waste must comply with the record keeping requirements of the Amarillo College Waste Disposal Program and State regulations. Written records must contain the following information:

- Date of treatment;
- Amount of waste treated;
- Method/conditions of treatment;
- Name (printed) and initials of person performing the treatment;
- If a department generates more than 50 pounds per calendar month of biohazardous waste, the records must also include:
 - a written procedure for the operation and testing of any equipment used, and
 - a written procedure for the preparation of any chemicals used in treatment,
- The records must also include:
 - either the results of a biological indicator, or
 - a continuous readout (eg, strip chart) to demonstrate proper parameters for effective treatment.

L. Bloodborne Pathogens

Bloodborne pathogens are biological agents that cause human disease.

Examples of bloodborne diseases include the following:

- Hepatitis;
- Syphilis;
- Malaria;
- Human Immunodeficiency Virus (HIV).

Two significant and deadly bloodborne diseases are hepatitis B virus (HBV) and

HIV These pathogens may be present in the following:

- Human blood;
- Body fluids, such as saliva, semen, vaginal secretions, phlegm, and other body fluids visibly contaminated with blood;
- Unfixed human tissues or organs other than intact skin;
- HIV or HBV cultures;
- Blood, organs, or other tissues from experimental animals infected with HIV or HBV.

Bloodborne pathogens may enter the body and infect you through a variety of means, including the following:

- Accidental injury with a sharp object contaminated with infectious material;
- Open cuts, nicks, and skin abrasions that come into contact with infectious materials;
- Other potential sites of transmission include:
 - acne sores, and
 - the mucous membranes of the mouth, nose, or eyes;
- Unprotected sexual activity with someone who is infected with the disease;
- Indirect transmission, such as touching a contaminated object and then transferring the pathogen to the mouth, eyes, nose, or open skin.

Currently, Federal or State regulations concerning bloodborne pathogens do not cover Amarillo College. If you suspect you have been exposed to a bloodborne pathogen, report the incident to your supervisor or instructor immediately.

XII. Chemical Safety:

Always follow these guidelines when working with chemicals:

- Assume that any unfamiliar chemical is hazardous;
- Know all the hazards of the chemicals with which you work,
 - For example, perchloric acid is a corrosive, an oxidizer, and a reactive,
 - Benzene is an irritant that is also flammable, toxic, and carcinogenic;
- Consider any mixture to be at least as hazardous as its most hazardous component;
- Never use any substance that is not properly labeled;
- Follow all chemical safety instructions precisely;
- Minimize your exposure to any chemical, regardless of its hazard rating;
- Use personal protective equipment, as appropriate;
- Use common sense at all times.

The five prudent practices of chemical safety sum up these safety guidelines:

- Treat all chemicals as if they were hazardous;
- Minimize your exposure to any chemical;
- Avoid repeated exposure to any chemical;
- Never underestimate the potential hazard of any chemical or combination of Chemicals;
- Assume that a mixture or reaction product is more hazardous than any component or reactant.

A. Material Safety Data Sheets:

Before using any chemical, read the container label and the appropriate Material Safety Data Sheets (MSDS) Container labels and MSDSs are good sources of information for chemical safety.

They provide the following information:

- Hazardous ingredients;
- Exposure limits;
- Physical and chemical characteristics, including the following:
 - Boiling point,
 - Vapor pressure;
- Physical hazards, including the following:
 - Flammability,
 - Explosiveness,
 - Reactivity;
- Health hazards, including chemicals that are:
 - Toxic,
 - Carcinogens,
 - Irritants;
- First-aid procedures;
- Proper leak, spill, and disposal techniques;
- Proper storage and handling procedures;
- Other special provisions.

B. Safe Handling Guidelines

Employees should treat all chemicals and equipment with caution and respect. When working with chemicals, remember to do the following:

- Remove and use only the amount of chemicals needed for the immediate job at hand;
- Properly seal, label, and store chemicals in appropriate containers;
- Keep the containers clearly marked and in a well-ventilated area;
- Check stored chemicals for deterioration and broken containers;

- Learn how to dispose of chemicals safely and legally Follow Amarillo College waste disposal requirements;
- Clean up spills and leaks immediately;
- Know what to do in an emergency.

Likewise, when working with chemicals, remember the following:

- Do not store chemicals near heat or sunlight or near substances that might initiate a dangerous reaction;
- Do not transport unprotected chemicals between the work area and other areas,
 - Use a tray, rack, cart or rubber carrier,
 - Always use a secondary container when transporting hazardous or highly odorous chemicals on an elevator;
- Do not pour hazardous chemicals down the sink;
- Do not put fellow workers or yourself in danger.

C. Hygiene and Chemical Safety

Good personal hygiene will help minimize exposure to hazardous chemicals.

When working with chemicals, follow these guidelines:

- Wash hands frequently and before leaving the laboratory;
- Also, wash hands before eating, drinking, smoking, or applying makeup;
- Remove contaminated clothing immediately,
 - Do not use the clothing again until it has been properly decontaminated;
- Follow any special precautions for the chemicals in use;
- In addition, follow these special precautions:
 - Do not eat, drink, smoke, or apply makeup around chemicals,
 - Do not wear contact lenses near chemicals, especially corrosives or volatile solvents,
 - Do not keep food or food containers anywhere near chemicals,
 - Do not use laboratory equipment to serve or store food or drinks,
 - Do not sniff or taste chemicals.

D. Hazard Communication Program:

Amarillo College has a written program (Amarillo College Hazard Communication Program) that complies with OSHA standards and the Texas Hazard Communication Act for hazardous chemicals.

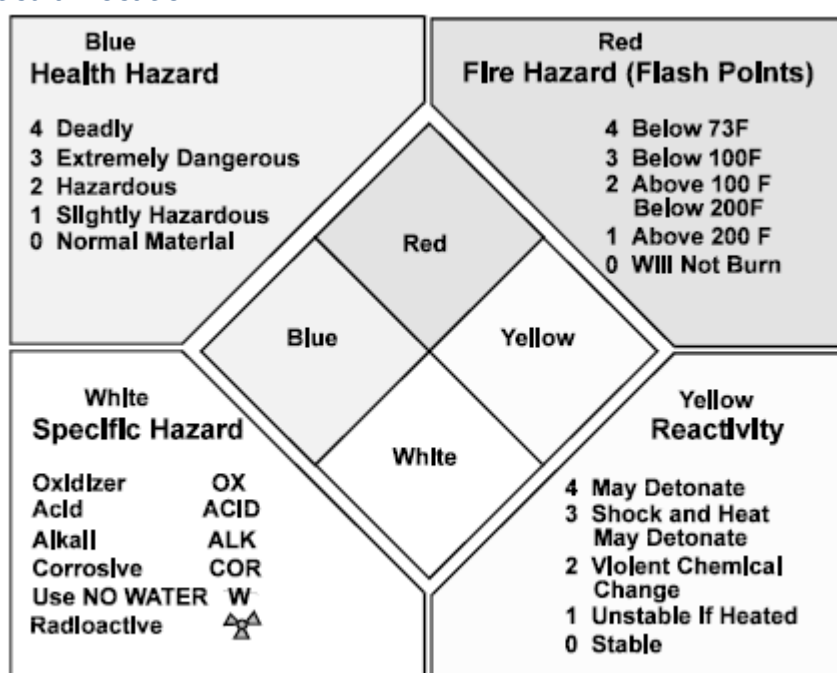
This program is available from the Emergency Manager. It requires the following:

- Employee training (including recognition of signs of exposure);
- Labeling procedures;

- MSDSs for chemicals at each workplace;
- Instructions on how to read and interpret MSDSs;
- Chemical inventory reporting procedures;
- Record keeping requirements;
- Emergency response procedures;



Refer to the Amarillo College Hazard Communication Program, and other sections in this manual for detailed information on these topics.

An integral part of hazard communication is hazard identification. Everyone who works with hazardous chemicals should know how to read and interpret hazard information. Signs, like the NFPA diamond in the illustration below, alert employees to the known hazards in a particular location.



The following is a detailed explanation of the NFPA hazard classification codes:

- Health (Blue):
 - Can cause death or major injury despite medical treatment;
 - Can cause serious injury despite medical treatment;
 - Can cause injury Requires prompt medical treatment;
 - Can cause irritation if not treated;
 - No hazard.
- Flammability (Red):
 - Very flammable gases or liquids;
 - Can ignite at normal temperatures;

- Ignites with moderate heat;
- Ignites with considerable preheating;
- Will not burn.
- Reactivity (Yellow):
 - Readily detonates or explodes;
 - May detonate or explode with strong initiating force or heat under Confinement;
 - Normally unstable, but will not detonate;
 - Normally stable Unstable at high temperature and pressure;
 - Normally stable and not reactive with water.
- Specific Hazard (White):
 - Oxidizer – OX;
 - Acid – ACID;
 - Alkali – ALK;
 - Corrosive – COR;
 - Use No Water –  W
 - Radioactive - 

E. Corrosives:

A corrosive chemical destroys or damages living tissue by direct contact. Some acids, bases, dehydrating agents, oxidizing agents, and organics are corrosives.

Examples of Corrosives:

- Examples of acidic corrosives include the following:
 - Hydrochloric acid;
 - Sulfuric acid;
 - Perchloric acid;
 - Hydrofluoric acid (also health hazard due to fluoride ion).
- Examples of alkaline corrosives include the following:
 - Sodium hydroxide (lye);
 - Potassium hydroxide.
- Examples of corrosive dehydrating agents include the following:
 - Phosphorous pentoxide;
 - Calcium oxide.

- Examples of corrosive oxidizing agents include the following:
 - Halogen gases;
 - Perchloric acid.
- Examples of organic corrosives include the following:
 - Phenol;
 - Acetic acid.

NOTE:

Concentrated acids can cause painful burns that are often superficial. Inorganic hydroxides, however, can cause serious damage to skin tissues because a protective protein layer does not form. Even a dilute solution such as sodium or potassium hydroxide can saponify fat and attack skin. At first, skin contact with phenol may not be painful, but the exposed area may turn white due to the severe burn Systemic poisoning may also result from dermal exposure.

1. Safe Handling Guidelines for Corrosives:

To ensure safe handling of corrosives, the following special handling procedures should be used:

- Always store corrosives properly;
- Refer to the MSDSs and the Chemical Storage section of this manual for more information;
- Always wear gloves and face and eye protection when working with corrosives,
 - Wear other personal protective equipment, as appropriate;
- To dilute acids, add the acid to the water, not the water to the acid;
- Corrosives, especially inorganic bases (eg, sodium hydroxide), may be very slippery; handle these chemicals with care and clean any spills, leaks, or dribbles immediately;
- Use a chemical fume hood when handling fuming acids or volatile irritants (eg, ammonium hydroxide);
- A continuous flow eye wash station should be in every work area where corrosives are present,
 - An emergency shower should also be within 100 feet of the area.

2. Corrosive Example: Perchloric Acid:

Perchloric acid is a corrosive oxidizer that can be dangerously reactive. At elevated temperatures, it is a strong oxidizing agent and a strong dehydrating reagent. Perchloric acid reacts violently with organic materials. When combined with

combustible material, heated perchloric acid may cause a fire or explosion. Cold perchloric acid at less than 70% concentration is not a very strong oxidizer, but its oxidizing strength increases significantly at concentrations higher than 70%. Anhydrous perchloric acid (>85%) is very unstable and can decompose spontaneously and violently. If possible, purchase 60% perchloric acid instead of a more concentrated grade. Always wear gloves and goggles while using perchloric acid. Be thoroughly familiar with the special hazards associated with perchloric acid before using it. Heated digestions with perchloric acid require a special fume hood with a wash-down system. The vapors can form crystals on the hood interior that are explosive.

4. Corrosive Example: Hydrofluoric Acid:

HF is one of the most dangerous common reagents that we use in a laboratory environment. Exposures of only 2% of the body to concentrated HF can lead to death, and it is also lethal at a concentration of 50 ppm in air. Fluoride ions bind rapidly to electrolytic ions in your tissues, such as Ca^{+2} , causing severe electrolyte imbalance. Death can occur in as little as 30 minutes. Death is usually from massive organ failure (heart failure, etc). If you do not die quickly you will develop severe burns and excruciating pain. The idea that HF primarily affects your bones is a common misunderstanding, bone problems only develop if you survive.

Protective Measures:

There are several ways to help prevent hydrofluoric acid accidents from occurring in the first place.

- Never use hydrofluoric acid when working solo or after hours,
 - HF may be used when working alone, only during regular working hours provided:
 - knowledgeable personnel have been alerted, and
 - at least one is in the general vicinity;
- All personnel, not just those who will be using hydrofluoric acid, should be informed of the dangers of this chemical, and
 - the emergency procedures necessary in case of an accident;
- All persons who will be using HF must be made aware of its properties and trained in proper procedures for use and disposal;
- Companies/Laboratories which keep or use HF gas or concentrated solutions (>1% hydrofluoric acid) should have these emergency procedures on hand as well as an MSDS;
- Students should never be given the task of mixing HF solutions,
 - Only experienced persons familiar with its properties should handle the concentrated acid;
- A small supply of calcium carbonate or calcium hydroxide should be kept near where the work will be conducted,
 - If a small quantity (100 ml or less) of dilute HF solution is spilled, clean it up by using powdered calcium carbonate or calcium hydroxide,

- A commercial hydrofluoric acid spill kit can also be used,
- If a large amount is spilled, or the HF is concentrated, contain the spill as best as can,
 - evacuate the area, and
 - call College police 371-5911,
 - Avoid exposure to the vapors;
- Dispose of unwanted hydrofluoric acid by contacting the Emergency Manager.
- When working with hydrofluoric acid or concentrated HF solutions (> 1%):
 - Wear goggles and a face shield,
 - Wear a long-sleeved, buttoned lab coat, pants or long skirt, and closed-toe shoes,
 - Wear Neoprene or Nitrile (22mil) gloves or other hydrofluoric acid resistant gloves (HF burns around the fingernails are extremely painful, difficult to treat, and may require surgical removal of the nail),
 - A chemical resistant apron is also recommended;
- Make sure to have a tube of HF "antidote" Ca-gluconate cream on hand in case HF comes into contact with the user's skin;
- Any person exposed to HF must seek immediate medical assistance;
- Please contact the Emergency Manager for further assistance if you plan to use HF or have need for disposal of HF solutions.

F. Flammables:

A flammable chemical is any solid, liquid, vapor, or gas that ignites easily and burns rapidly in air. Consult the appropriate MSDSs before beginning work with flammables.

1. Flashpoint, Boiling Point, Ignition Temperature, and Class:

Flammable chemicals are classified according to flashpoint, boiling point, and ignition temperature. Flashpoint (FP) is the lowest temperature at which a flammable liquid gives off sufficient vapor to ignite. Boiling point (BP) is the temperature at which the vapor pressure of a liquid is equal to the atmospheric pressure under which the liquid vaporizes. Flammable liquids with low BPs generally present special fire hazards. The FPs and BPs of certain chemicals are closely linked to their ignition temperature — the lowest temperature at which a chemical will ignite and burn independently of its heat source.

The following table illustrates flammable class characteristics (OSHA Std 1910106 and NFPA 30):

CLASS	FLASHPOINT (°F)	BOILING POINT (°F)	EXAMPLES
1A	<73	<100	Ethyl ether "Flammable" aerosols
1B	<73	≥100	Acetone Gasoline Toluene
1C	≥73	<100	Butyl alcohol Methyl isobutyl ketone Turpentine
2	100 - 140	---	Cyclohexane Kerosene Mineral spirits
3A	140 - 199	---	Butyl cellosolve
3B	≥200	---	Cellosolve Ethylene glycol Hexylene glycol

The following table provides examples of common flammables and their flashpoint and class:

CHEMICAL	FLASHPOINT (°F)	CLASS
Acetone	0	1B
Benzene	12	1B
Butyl Acetate	>72	1C
Carbon Disulfide	-22	1B
Cyclohexane	-4	1B
Diethylene Glycol	225	3B
Diethyl Ether	-49	1A
Ethanol	55	1B
Heptane	25	1B
Isopropyl Alcohol	53	1B
Methanol	52	1B
Pentane	<-40	1A
Toulene	40	1B

G. Conditions for a Fire:

Improper use of flammable liquids can cause a fire.

The following conditions must exist for a fire to occur:

- Flammable material must be present in sufficient concentration to support a fire (ie, fuel);
- Oxygen or another oxidizer must be present;
- An ignition source must be present (ie, heat, spark, etc);
- When working with flammables, always take care to minimize vapors which act as fuel.

H. Safe Handling Guidelines for Flammables:

Follow these guidelines when working with flammable chemicals:

- Handle flammable chemicals in areas free from ignition sources;
- Never heat flammable chemicals with an open flame,
 - Use a water bath, oil bath, heating mantle, hot air bath, etc.;
- Use ground straps when transferring flammable chemicals between metal containers to avoid generating static sparks ;
- Use a fume hood when there is a possibility of dangerous vapors (Ventilation will help reduce dangerous vapor concentrations);
- Restrict the amount of stored flammables, and minimize the amount of flammables present in a work area;
- Remove from storage only the amount of chemical needed for a particular experiment or task.

I. Solvents:

Organic solvents are often the most hazardous chemicals in the work place. Solvents such as ether, alcohols, and toluene, for example, are highly volatile or flammable. Chlorinated solvents such as chloroform are nonflammable, but when exposed to heat or flame, may produce carbon monoxide, chlorine, phosgene, or other highly toxic gases.

Always use volatile and flammable solvents in an area with good ventilation or in a fume hood. Never use ether or other highly flammable solvents in a room with open flames or other ignition sources present.

1. Solvent Exposure Hazards:

Health hazards associated with solvents include exposure by the following routes:

- Inhalation of a solvent may cause bronchial irritation, dizziness, central nervous system depression, nausea, headache, coma, or death.
- Prolonged exposure to excessive concentrations of solvent vapors may cause liver or kidney damage.
- The consumption of alcoholic beverages can enhance these effects;

- Skin contact with solvents may lead to defatting, drying, and skin irritation;
- Ingestion of a solvent may cause severe toxicological effects,
 - Seek medical attention immediately.

The odor threshold for the following chemicals exceeds acceptable exposure limits. Therefore, if you can smell it, you may be overexposed — increase ventilation immediately.

- Chloroform;
- Benzene;
- Carbon tetrachloride;
- Methylene chloride;
- Formaldehyde.

NOTE:

Do not depend on your sense of smell alone to know when hazardous vapors are present. The odor of some chemicals is so strong that they can be detected at levels far below hazardous concentrations (eg, xylene).

In addition, some solvents (eg, benzene) are known or suspected carcinogens.

2. Reducing Solvent Exposure:

To decrease the effects of solvent exposure, substitute hazardous solvents with less toxic or hazardous solvents whenever possible. For example, use hexane instead of diethyl ether, benzene or a chlorinated solvent.

NOTE:

The best all-around solvent is water; use it whenever possible

The following table outlines possible solvent substitutions:

Instead of Using	Substitute
Benzene	Cyclohexane Toluene Xylene
Halogenated Solvents	Non-Halogenated Solvents
Aromatic hydrocarbon	Aliphatic hydrocarbon
Trichloroethylene	1,1,1-trichloroethane
Diethyl ether	Hexane Petroleum ether

3. Solvent Example: DMSO:

Dimethyl sulfoxide is unique because it is a good solvent with many water-soluble as well as lipid-soluble solutes. Due to these properties, dimethyl sulfoxide is rapidly absorbed and distributed throughout the body. It can also facilitate absorption of other chemicals such as grease, oils, cosmetics, and other chemicals that may contact the skin.

J. Toxic Chemicals:

The toxicity of a chemical refers to its ability to damage an organ system (kidneys, liver), disrupt a biochemical process (eg, the blood-forming process) or disturb an enzyme system at some site remote from the site of contact. Toxicity is a property of each chemical that is determined by molecular structure.

Any substance can be harmful to living things. But, just as there are degrees of being harmful, there are also degrees of being safe. The biological effects (beneficial, indifferent or toxic) of all chemicals are dependent on a number of factors. For every chemical, there are conditions in which it can cause harm and, conversely, for every chemical, there are conditions in which it does not.

A complex relationship exists between a biologically active chemical and the effect it produces that involves consideration of dose (the amount of a substance to which one is exposed), time (how often, and for how long during a specific time, the exposure occurs), the route of exposure (inhalation, ingestion, absorption through skin or eyes), and many other factors such as gender, reproductive status, age, general health and nutrition, lifestyle factors, previous sensitization, genetic disposition, and exposure to other chemicals.

The most important factor is the dose-time relationship.

The dose-time relationship forms the basis for distinguishing between two types of toxicity:

- acute toxicity and chronic toxicity,
 - The acute toxicity of a chemical refers to its ability to inflict systemic damage as a result (in most cases) of a one-time exposure to relative large amounts of the chemical. In most cases, the exposure is sudden and results in an emergency situation,
 - Chronic toxicity refers to a chemical's ability to inflict systemic damage as a result of repeated exposures, over a prolonged time period, to relatively low levels of the chemical;
- Some chemicals are extremely toxic and are known primarily as acute toxins (hydrogen cyanide);
- Some are known primarily as chronic toxins (lead);

- Other chemicals, such as some of the chlorinated solvents, can cause either acute or chronic effects;
- The toxic effects of chemicals can range from mild and reversible (eg a headache from a single episode of inhaling the vapors of petroleum naphtha that disappears when the victim gets fresh air),
 - to serious and irreversible (liver or kidney damage from excessive exposures to chlorinated solvents);
- The toxic effects from chemical exposure depend on the severity of the exposures;
- Greater exposure and repeated exposure generally lead to more severe effects.

Exposure to toxic chemicals can occur by:

- Inhalation;
- Dermal absorption;
- Ingestion;
- Injection.

NOTE:

Inhalation and dermal absorption are the most common methods of chemical exposure in the workplace.

The following sections provide examples and safe handling guidelines for the following types of toxic chemicals:

- Toxicants;
- Carcinogens;
- Reproductive Toxins;
- Sensitizers;
- Irritants.

¡IMPORTANT!

Minimize your exposure to any toxic chemical.

1. Acute Toxins:

Acute toxins can cause severe injury or death as a result of short-term, high-level exposure.

Examples of acute toxins include the following:

- Hydrogen cyanide;
- Hydrogen sulfide;
- Nitrogen dioxide;
- Ricin;

- Organophosphate pesticides;
- Arsenic.

Do not work alone when handling acute toxins. Use a fume hood to ensure proper ventilation.

2. Chronic Toxins:

Chronic toxins cause severe injury after repeated exposure.

Examples of chronic toxins include the following:

- Mercury;
- Lead;
- Formaldehyde.

3. Carcinogens:

Carcinogens are materials that can cause cancer in humans or animals. Several agencies including OSHA, NIOSH, and IARC are responsible for identifying carcinogens.

There are very few chemicals known to cause cancer in humans, but there are many suspected carcinogens and many substances with properties similar to known carcinogens.

Examples of known carcinogens include the following:

- Asbestos;
- Benzene;
- Tobacco smoke;
- Chromium, hexavalent;
- Aflatoxins.

Zero exposure should be the goal when working with known or suspected carcinogens. Workers who are routinely exposed to carcinogens should undergo periodic medical examinations.

4. Reproductive Toxins:

Reproductive toxins are chemicals that can produce adverse effects in parents and developing embryos. Chemicals including heavy metals, some aromatic solvents (benzene, toluene, xylenes, etc), and some therapeutic drugs are capable of causing these effects.

In addition, the adverse reproductive potential of ionizing radiation and certain lifestyle factors, including excessive alcohol consumption, cigarette smoking, and the use of illicit drugs, are recognized.

While some factors are known to affect human reproduction, knowledge in this field (especially related to the male) is not as broadly developed as other areas of toxicology. In addition, the developing embryo is most vulnerable during the time before the mother knows she is pregnant. Therefore, it is prudent for all persons with reproductive potential to minimize chemical exposure.

5. Sensitizers:

Sensitizers may cause little or no reaction upon first exposure. Repeated exposures may result in severe allergic reactions.

Examples of sensitizers include the following:

- Isocyanates;
- Nickel salts;
- Beryllium compounds;
- Formaldehyde;
- Diazomethane.

6. Irritants:

Irritants cause reversible inflammation or irritation to the eyes, respiratory tract, skin, and mucous membranes. Irritants cause inflammation through long-term exposure or high concentration exposure. For the purpose of this section, irritants do not include corrosives.

Examples of irritants include the following:

- Ammonia;
- Formaldehyde;
- Halogens;
- Sulfur dioxide;
- Poison ivy;
- Phosgene.

K. Reactives and Explosives:

Reactive chemicals are sensitive to either friction or shock or they react in the presence of air, water, light, or heat. Explosive chemicals decompose or burn very rapidly when subjected to shock or ignition. Reactive and explosive chemicals produce large amounts of heat and gas; they are extremely dangerous.

Examples of reactive compounds include the following:

REACTIVE CLASSIFICATION	CHEMICAL EXAMPLES
Acetylenic compounds	Acetylene Copper(I) acetylide
Azides	Benzenesulfonyl azide Lead (II) azide
Azo compounds	Azomethane Diazomethane
Chloro/perchloro compounds	Lead perchlorate Potassium chlorite Silver chlorate
Fulminates	Copper (II) fulminate Silver fulminate
Nitro compounds	Nitromethane Trinitrotoluene
Nitrogen-containing compounds	Silver amide Silver nitride
Organic peroxide formers	Diethyl ether Isopropyl ether
Picrates	Picric acid (dry) Lead picrate
Peroxides	Diacetyl peroxide Zinc peroxide
Strained ring compounds	Benzvalene Prismane
Polymerizable compounds	Butadiene Vinyl chloride

L. Cleaning Agents:

Many of the chemicals contained in cleaning agents are corrosive.

Follow these guidelines when working with any cleaning agent:

- Always read and understand the label instructions or the MSDS before using any cleaning agent;
- Mix solutions to the recommended strength;

- When diluting acid with water, always add the acid to the water, not the water to the acid (Concentrated acids may splatter when mixed improperly);
- Wear appropriate eye protection and gloves for the job (eg, neoprene, nitrile, or rubber);
- Do not leave aerosol cans in direct sunlight or areas where the temperature may exceed 120°F,
 - Heated aerosol cans may explode.

The following table outlines common cleaning agents, their hazards, and safety precautions:

CLEANING AGENT	POSSIBLE HAZARDS	SAFETY MEASURES
Ammonia	Can cause severe eye and lung irritation. If mixed with bleach, can form poisonous chlorine gas.	Use in a well ventilated area. Do not mix with bleach. Wear eye protection.
Bleach	Can produce a poisonous gas if mixed with other cleaners.	Never mix with toilet cleaners or ammonia. Wear gloves and eye protection.
Toilet/Drain Cleaners & Lye	Can cause serious burns.	Wear gloves and avoid skin contact. Never mix with bleach. Protect eyes from possible splashes
Cleaning Fluids/Degreasers	May cause skin and eye irritations. May contain solvents that can cause headaches, painful cough, dizziness, and liver or kidney damage.	Avoid direct contact. Only use in well-ventilated areas. Follow label directions carefully.
Aerosol Sprays	Can irritate nasal passages if inhaled. Can cause eye irritation.	Follow label directions carefully. Use in well ventilated area.
Floor Waxes & Furniture Polish	Can irritate skin and nasal passages	Use in well ventilated area. Avoid skin contact.

M. Fume Hoods:

Fume hoods provide primary confinement in a chemical laboratory. They exhaust toxic, flammable, noxious, or hazardous fumes and vapors by capturing, diluting, and removing these materials. Fume hoods also provide physical protection against fire, spills, and explosion. Fume hoods provide the best protection when the fume hood sash is in the closed position.

All chemical fume hoods must be ducted to the outside of the building.

1. Types of Fume Hoods:

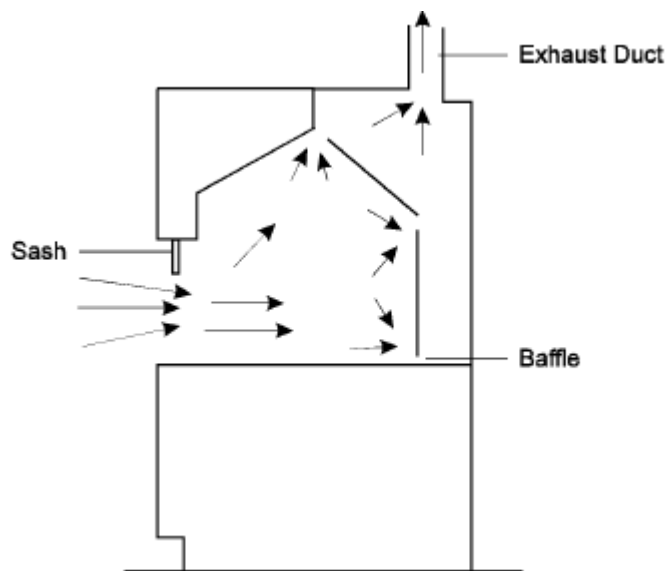
There are three basic types of fume hoods:

- (1) standard,
- (2) bypass, and
- (3) auxiliary air.

In addition, at Amarillo College, there are three classes of fume hoods: A, B, and C.

a) STANDARD FUME HOODS:

The face velocity of a standard fume hood is inversely related to the open face area, allowing a constant volume of air to be exhausted. If the sash is lowered, the inflow air velocity increases.



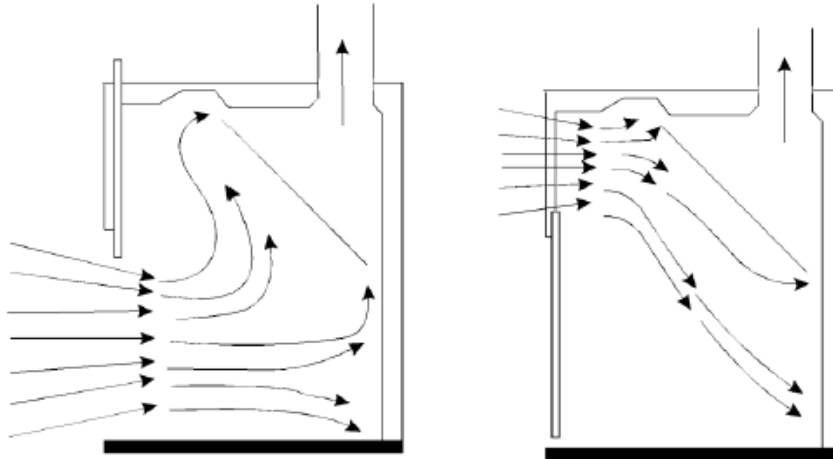
Standard Fume Hoods

!IMPORTANT!

Face velocity that is too high may disturb sensitive apparatus, extinguish Bunsen burners, or create excessive turbulence.

b) BYPASS FUME HOODS:

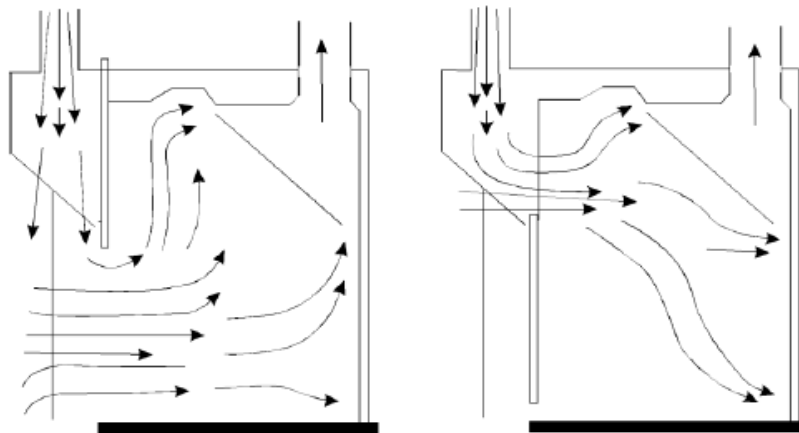
Bypass fume hoods are also called "balanced air" or "constant volume" fume hoods. As the sash is lowered, bypass fume hoods allow constant exhaust volumes that help keep the room ventilation system balanced. Constant exhaust volumes also eliminate the problem of high face velocity as the sash is lowered.



Bypass Fume Hoods

c) AUXILIARY AIR FUME HOODS:

Auxiliary air fume hoods are also known as "supplied air" hoods. They use an outside air supply for 50% to 70% of the hood's exhaust requirements. This type of hood is designed to reduce utility costs and conserve energy. The face velocity of an auxiliary air fume hood may vary.



Auxiliary Air Fume Hoods

2. Classifications:

The following guidelines are recommendations for face velocities of three classes of chemical fume hoods:

a) Class A Fume Hood:

Recommended average face velocity is 115 to 125 fpm with a minimum of 100 fpm at any point. This class of hood is suitable for use with highly toxic or volatile materials

having a TLV of less than 1 ppm (eg, tetraethyl lead, beryllium compounds, metal carbonyls, and carcinogens).

b) Class B Fume Hood:

Recommended average face velocity is 95 to 110 fpm with a minimum of 80 fpm at any point. This class of hood is suitable for use with materials having a TLV of 1-100 ppm (eg, acids, formaldehyde, chloroform, and phenol).

c) Class C Fume Hood:

Recommended average face velocity is 75 to 95 fpm with a minimum of 60 fpm at any point. This class of fume hood is suitable for use with materials having a TLV greater than 100 ppm (eg, ethanol, butanol, and acetone). It is also suitable for operations that create nuisance dust and fumes.

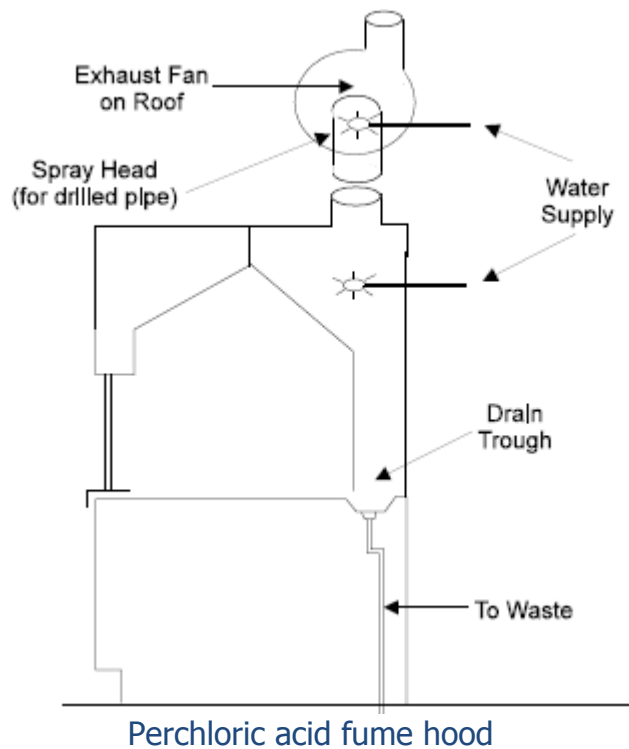
3. Special Fume Hoods:

Special fume hoods are necessary when working with certain chemicals and operations.

Examples of special fume hoods include the following:

a) Perchloric acid fume hoods:

These fume hoods have a water spray system to wash down the entire length of the exhaust duct, the baffle, and the wall. The water spray is used periodically or after each use to remove any perchloric acid or organic material that may accumulated.



b) Walk-in hoods:

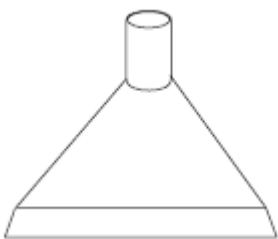
These fume hoods have single vertical sashes or double vertical sashes and an opening that extends to the floor. These hoods are typically used to accommodate large pieces of equipment.

c) Radioisotope hoods:

These hoods are labeled for use with radioactive materials. The interior of these hoods are resistant to decontamination chemicals. If special filtration is necessary with these fume hoods, contact the College's Radiological Officer or the Emergency Manager.

d) Canopy hoods:

These hoods capture upward moving contaminants and are good for heat-producing operations. Workers may be exposed to contaminants if they work under the hood, however.



Canopy Fume Hood

4. Fume Hood Safety Considerations:

The potential for glass breakage, spills, fires, and explosions is great within a fume hood. Due to the chance for fires or explosions, fume hoods should be located towards the back of a laboratory, away from primary and secondary exits.

Practice safe work habits when working with fume hoods, including the following:

a) Air Flow and Ventilation:

Employee traffic in front of a fume hood or opening/closing laboratory doors can interfere with hood performance. Ensure that there is sufficient aisle space in front of fume hoods.

b) Fume Hood Type:

All fume hoods are not appropriate for all types of work. Ensure that hazardous chemicals are used in the proper type or class of hood. For example, use perchloric acid only in fume hoods specifically designed for perchloric acid.

5. Fume Hood Use and Care:

To ensure safety and proper fume hood performance, follow these guidelines:

- Use a fume hood when working with chemicals or procedures that may produce hazardous fumes or vapors;
- Know how to properly operate a fume hood before beginning work,
 - Inspect the fume hood before starting each operation;
- Place equipment and chemicals at least six inches behind the fume hood sash,
 - This practice reduces the chance of exposure to hazardous vapors;
- Do not allow paper or other debris to enter the exhaust duct of the hood;
- Do not store excess chemicals or equipment in fume hoods;
- Do not block the baffle area of the fume hood;
- Elevate any large equipment within the hood at least three inches to allow proper ventilation around the equipment;
- When working in a fume hood,

- set the sash at the height, indicated by the arrow on the inspection sticker,
- The only time the sash should be completely open is while setting up equipment;
- Wear personal protective equipment, as appropriate;
- Do not alter/modify the fume hood or associated duct work;
- Clean up spills in the hood immediately.

!IMPORTANT!

If a power failure or other emergency occurs (eg, building fire or fire within the fume hood), close the fume hood sash and call for emergency assistance.

6. Fume Hood Inspections:

Fume hoods should be tested at least annually.

Fume hoods should also be tested in the following circumstances:

- When an employee requests an inspection;
- When a procedural change requires a hood classification upgrade;
- After major repair work;
- After a fume hood is moved.

Amarillo College may use an approved and qualified vendor to perform fume hood inspections and testing. The test includes an inspection of the hood system, airflow measurements, and an assessment of the use of the fume hood. If you suspect a problem with your fume hood, please contact the manufacturer, the Physical Plant or the Emergency Manager.

N. Spill Response:

Spills are likely whenever chemicals are used. Personnel should be trained and equipped to handle most of the spills in their work area. Contact the Emergency Manager for assistance or advice about a chemical spill.

Spills that endanger the community or environment must be immediately reported to the College Police to seek first responder, hazardous waste response teams (HAZMAT Team). Spills that cannot be immediately remediated but are not a danger to the community or environment must be reported to Physical Plant.

1. Spill Prevention and Planning:

Prevention is the best safety strategy for any environment. Use safe handling procedures and be aware of the potential hazards associated with chemicals. For example, before working with any chemicals, review the appropriate MSDSs.

Be prepared to respond to a chemical spill.

To prepare for a potential spill, follow these guidelines:

- Develop and periodically review written procedures for an emergency response plan for your Department, Laboratory or Classroom;
- Be familiar with and review the Amarillo College Threat Prevention and Response Manual;
- Keep a fully stocked chemical spill response kit available;
- Know the location and proper use of cleanup materials;
- Know how to turn off equipment, heat sources, electrical panels, etc.;
- Review appropriate MSDSs.

2. Spill Response Kit:

Work and educational areas that contain potentially hazardous chemicals should have a chemical spill response kit.

This kit should include the following:

- Disposable laboratory/surgical gloves;
- Disposable vinyl gloves;
- Safety goggles;
- Absorbent (eg, spill pillows, vermiculite, litter box filler, etc);
- Plastic scoop;
- Plastic trash bags.

3. Responding to Chemical Spills:

The following sequence provides a brief overview of proper chemical response procedures:

- Notify others in the immediate area that a spill has occurred;
- Evacuate the area if necessary;
- Attend to injured and exposed people;
- Identify the spilled chemical(s);
- Based on the hazards and the personal protective equipment needed (eg, respiratory protection), determine:
 - If you can safely clean the spill or if assistance is necessary (Most spills can be cleaned safely by the people who were using the chemical, assuming they are knowledgeable about the chemical);
- If you determine that you can safely clean the spill without emergency assistance, follow these guidelines:
 - Wear appropriate protective clothing and equipment,
 - Have another person stand by during the cleanup,

- Clean up the spill and collect all wastes for proper disposal,
- Ventilate the area, as necessary, before it is reoccupied,
- Decontaminate reusable cleanup supplies such as scoops, rubber boots, etc,
- Restock the chemical spill kit and return it to the normal storage location
- Do not take unnecessary risks with chemical spills Call COLLEGE POLICE (to notify and coordinate with the primary responders) by dialing 371-5911 whenever a spill involves the following:
 - Large volume of spilled material,
 - Very hazardous material,
 - Very hazardous conditions (eg, fire, explosion, toxicity, etc),
 - Strong odor,
 - Personnel injury or exposure
- For additional emergency response procedures, review the Amarillo College Emergency Prevention and Response Manual.

O. Chemical Storage:

Proper chemical storage is as important to safety as proper chemical handling. Often, seemingly logical storage ideas, such as placing chemicals in alphabetical order, may cause incompatible chemicals to be stored together.

1. General Guidelines:

Follow these guidelines for safe chemical storage:

- Read chemical labels and MSDSs for specific storage instructions;
- Store chemicals in a well-ventilated area; however, do not store chemicals in a fume hood;
- Maintain an inventory of all chemicals in storage;
- Return chemical containers to their proper storage location after use;
- Store glass chemical containers so that they are unlikely to be broken;
- Store all hazardous chemicals below eye level;
- Never store hazardous chemicals in a public area or corridor.

2. Separating Hazardous Chemicals:

In addition to the guidelines above, there are storage requirements for separating hazardous chemicals. Because an alphabetical storage system may place incompatible chemicals next to each other, group chemicals according to their hazard category (ie, acids, bases, flammables, etc).

Follow these guidelines to ensure that hazardous chemicals are stored safely:

- Separate acids from bases, Store these chemicals near floor level;
- Isolate perchloric acid from organic materials,
 - Do not store perchloric acid on a wooden shelf;
- Separate highly toxic chemicals and carcinogens from all other chemicals,
 - This storage location should have a warning label and should be locked;
- Separate acids from flammables;
- Do not keep peroxide-forming chemicals longer than twelve months;
- Do not allow picric acid to dry out;
- If flammables need to be chilled, store them in a laboratory-safe refrigerator, not in a standard refrigerator;
- Flammables should be stored in a flammable storage cabinet.

The following table provides examples of incompatible chemicals:

CHEMICAL	INCOMPATIBLE WITH
Acetic acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Acetone	Concentrated nitric and sulfuric acid mixtures
Alkali metals	Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, halogens
Ammonia	Mercury, chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid
Chlorates	Ammonium salts, acids, powdered metals, sulfur, finely divided organic or combustible materials
Chlorine	Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, benzene, finely divided metals, turpentine
Cyanide	Acids
Fluorine	Most other chemicals
Nitrates	Sulfuric acid
Oxygen	Oils, grease, hydrogen, flammable liquids, solids, or gases
Perchloric acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood, grease, oils
Sodium	Carbon tetrachloride, carbon dioxide, water
Sulfides	Acids

3. Shipping/Receiving Chemicals:

The US Department of Transportation regulates the shipment of hazardous materials. Anyone who packages, receives, unpacks, signs for, or transports hazardous chemicals

must be trained and certified in Hazardous Materials. Transportation Warehouse personnel, shipping and receiving clerks, truck drivers, and other employees who pack or unpack hazardous materials must receive this training. Contact the Physical Plant for more information on shipping or receiving hazardous chemicals.

XIII. Hazardous Waste Guidelines:

Hazardous waste disposal is governed by the EPA and the Texas Commission on Environmental Quality (TCEQ) through State and Federal regulations. The purpose of environmentally sound disposal methods is to prevent harm to the water, land, and air.

Amarillo College complies with hazardous waste disposal regulations by means of the Hazardous Waste Management Program. The Emergency Manager administers this program.

A. Permits and Requirements:

Amarillo College is a "Conditionally Exempt, Small Quantity Generator" of hazardous waste. The College's EPA and TCEQ Generator Registration IDs apply to all College activities. The Emergency Manager will assist any division, department or campus in determining its hazardous waste disposal needs.

B. Penalties of Noncompliance:

Noncompliance with any hazardous waste regulation may result in substantial fines and penalties for the College. The College may be cited or fined for numerous types of violations ranging from improperly labeling a waste container to intentionally disposing of hazardous waste incorrectly.

C. Role of the Emergency Manager:

The Emergency Manager administers the Hazardous Waste Management Program at Amarillo College. Compliance with this program is very demanding — it requires full cooperation by all campus entities. The main focus of this program is chemical waste management (Hazardous and Class 1 Industrial). The program does not include procedures for the management of radioactive, infectious, biological, or municipal solid waste.

The Emergency Manager collects, transports, and stores unused hazardous materials in the Amarillo College Intermediate Hazardous Materials Storage Area until they are repurposed or shipped for final disposal. The Emergency Manager also collects, transports, and stores hazardous waste, (not to exceed 90 days) until it is shipped for final disposal. The Emergency Manager also maintains permanent records (manifests) of all disposed waste. Contact the Emergency Manager for more information on hazardous waste disposal.

D. Definitions:

- Container Accumulation Area(s) (CAAs):
Designated by the Emergency Manager to be used for the storage of hazardous wastes (less than 90 days) prior to shipment to permitted waste disposal waste storage area;
- Disposal:
The proper disposition of hazardous and Class 1 Industrial waste at a permitted treatment, storage or disposal (TSD) facility in compliance with all applicable TCEQ and EPA regulations;
- Generator:
Any person, by site, who produces hazardous waste or industrial solid waste; any person who possesses hazardous waste or industrial solid waste to be shipped to any other person; or any person whose act first causes solid waste to become subject to regulation. Generators accumulate waste in Satellite Accumulation Areas;
- Hazardous Waste:
Any solid waste material listed or identified in Title 40 Code of Federal Regulations, Part 261, Subpart D or exhibiting the characteristics of ignitability, corrosivity, reactivity, or EP toxicity also defined in 40CFR Part 261 Subpart C Tables containing the listing and characteristics of hazardous wastes are shown in these subparts and the list of hazardous waste identified by the TCEQ in Texas may be found at the following internet location:

<http://www.tceq.state.tx.us/publications/rg/rg-022.html>
- Mixed Waste:
A radioactive waste that is also a hazardous waste;
- Satellite Accumulation Area(s):
A storage location at or near the point of generation where hazardous waste initially accumulates. The SAA are limited to storage of less than 55 gallons;
- Solid Waste:
Any garbage, refuse, sludge from a waste treatment plant, water treatment plant, or air pollution control facility or other discarded material. Solid waste can be solid, liquid, semi-solid, or contained gaseous material resulting from industrial, municipal, commercial, mining and agricultural operations, and from community and institutional activities.

E. Types of Hazardous Waste:

An item is considered waste when the owner determines that the material is no longer useful and needs to be discarded. A detailed description of the wastes generated at the College is in the Waste Analysis Plan. An item is considered to be hazardous waste if it meets one or more of the following characteristics:

- Mixture contains a listed hazardous waste and a non-hazardous waste;
- Material meets the definition of one of the following:
 - Ignitability (flashpoint < 60° C or supports combustion),
 - Reactivity (eg, water reactives, cyanides, explosives, unstable chemicals),
 - Corrosivity (ph < 2 or > 12.5),
 - EP toxicity (eg, pesticides, heavy metals, organic compounds, see Waste Analysis Plan, Attachment C),
 - Material is listed in 40CFR 261, Subpart D, or the list of hazardous waste identified by the TCEQ in Texas may be found at the following internet location:

<http://www.tceq.state.tx.us/publications/rg/rg-022.html>
 - Material is not excluded from regulations
- Individual departments are responsible for properly identifying the hazardous waste they generate and for following College disposal procedures;
- Departments should contact the Emergency Manager for assistance if necessary to characterize hazardous waste through process knowledge or chemical analysis.

F. Containers, Tags, and Collection:

Proper containment, tagging, collection and disposal are essential to the success of the Hazardous Waste Program.

The following sections discuss these areas:

1. Filling Containers:

Hazardous waste collection containers must be in good condition, must not leak, and must be compatible with their hazardous contents (eg, do not use metal containers for corrosive waste or plastic containers for organic solvents). All containers must have suitable screw caps or other secure means of closure. Your Department should provide 5-gallon poly-ethylene carboys that meet most of these compatibility requirements.

When large waste containers (greater than 5 gallons total volume) are warranted, contact the Emergency Manager for assistance. If you are reusing a container to accumulate waste, destroy the original product label. EPA regulations require that waste containers be labeled with the identity of the contents, and the words "Hazardous Waste".

The Emergency Manager can provide hazardous waste ID tags that meet these requirements.

The Emergency Manager will add the accumulation start date when the waste is picked up from the department and transported to the CAA(s).

¡IMPORTANT!

Never overfill hazardous waste containers. Expansion and excess weight can lead to spills, explosion, and extensive environmental exposure Do not fill past the shoulder of the container. The shoulder of the container is the place where the container slopes in towards the neck. Fill closed head cans (5 gallons or less) to leave approximately two inches of space between the liquid level and the top of the container. Fill closed head drums (larger than 5 gallons) to leave approximately four inches of space. Hazardous waste containers for solids are generally rated by their weight capacity and volume capacity. Take care not to exceed the weight capacity of a solid container. Weight is generally not a problem for jars and open head cans (5 gallons or less), but it can be a problem for open head drums (larger than 5 gallons) Depending on weight requirements, you may fill containers for solids within two inches of the closure.

¡IMPORTANT!

Keep all waste collection containers closed except when adding or removing material.

2. Completing Tags:

When a container first receives waste it is necessary to attach a waste tag.

Follow these guidelines for completing hazardous waste tags:

- Use full chemical names or common names,
 - Chemical formulas or abbreviations are not acceptable;
- List all chemical components in the waste container, including water,
 - Long lists may be continued on a second tag;
- Indicate the percent concentration of the chemicals,
 - especially potentially explosive materials such as picric acid and nitro compounds;
- Attach the tag to the container.

3. Collection and Disposal:

- The Emergency Manager collects waste from generators on a weekly basis;
- Specific details concerning waste pickup procedures are in the Amarillo College Hazardous Waste Management Plan, for Hazardous and Non-hazardous Waste Pickup;
- Containers with improper caps, leaks, outside contamination, or improper labeling will not be picked up until these problems have been corrected;

Improper disposal methods for hazardous chemical waste include the following:

- Disposal down the drain;
- Intentional evaporation in a fume hood;
- Disposal in the regular trash;
- Dilution and disposal down the drain.

4. Disposing of Empty Containers:

EPA and TCEQ (40CFR 264170, and TAC 33541(f), TAC 335508(2)) regulations stipulate that empty containers must meet the following requirements:

- Containers must not contain free liquid or solid residue;
- Containers must be triple rinsed (place the rinsate in an approved waste container);
- Product labels must be defaced or removed;
- Container lids or caps must be removed;
- Aerosol cans must be at atmospheric pressure.

!IMPORTANT!

Containers that do meet these requirements will be picked up for disposal by Emergency Manager.

G. Minimization and Substitution:

The cost of commercial waste disposal continues to rise and the amount of waste generated continues to increase. Amarillo College cannot control disposal costs, but it can reduce the amount of waste generated.

The following sections discuss how to minimize waste sources and waste products.

H. Waste Source Reduction Techniques:

Use the following techniques to reduce waste sources:

- Purchasing and Inventory Control:
 - Use computerized tracking systems to manage purchasing and control inventory,
 - Maintain current inventory records to prevent overstocking and to monitor the shelf life of remaining chemicals,
 - Develop a campus-wide chemical exchange network to promote chemical sharing and avoid redundant purchases,
 - Negotiate with suppliers to gain volume discounts, flexible delivery schedules, and delivery of fewer small-sized containers without cost penalties,

- Purchase quantities for immediate use only,
Do not order quantities to obtain a special unit cost savings,
- Obtain compressed gases from vendors who accept return of empty or partially full cylinders,
- Include waste generation as criteria in equipment selection,
- Rotate chemical stocks to use chemicals before their shelf-life expires.
- Chemical Usage:
 - Use lab procedures that assure the integrity of chemical quality,
 - Reduce spills and waste by pre-weighing chemicals for undergraduate use,
 - Require proper labeling of all secondary containers,
Replace all deteriorating labels on primary and secondary containers,
 - Substitute less hazardous chemicals whenever possible (eg, biodegradable scintillation cocktails instead of xylene or toluene-based cocktails),
 - Minimize the use of heavy metals (eg, silver, chromium, mercury, barium, cadmium, and lead),
 - Substitute alcohol or electronic thermal monitors for mercury thermometers,
 - Use "No-Chromix", detergents, or enzymatic cleaners to clean laboratory glassware,
 - Minimize solvent waste by recycling or substitution;
- Waste Minimization Techniques:

Follow these techniques to reduce hazardous waste:

 - Establish a Faculty Task Force to review waste streams and recommend waste minimization procedures,
 - Do not mix different types of waste,
 - Do not put non-hazardous waste, such as a mixture of water, sodium bicarbonate, and acetic acid, into a waste container of hazardous waste,
 - Do not combine inorganic heavy metal waste with organic solvents waste,
 - Segregate halogenated waste solvents from non-halogenated waste solvents,
 - Segregate waste streams by storing them in separate waste containers,
 - Store waste containers separate from reagent containers being used to avoid accidental contamination,
 - Decontaminate empty containers to make them non-hazardous,
 - Neutralize dilute acids and bases to make them non-hazardous and suitable for drain disposal (ie as long as no heavy metals are in solution),
 - When possible, redesign experimental protocols so that harmful byproducts are detoxified or reduced,
 - Recycle chemicals via purification,
 - Make lab employees accountable for waste when labs are decommissioned;
- Segregation:

Segregated waste is safer and easier to dispose of than nonsegregated waste; Mixed waste, for example, must be handled as both radioactive waste and hazardous waste; Each employee who generates waste is personally responsible for the following:

- Ensuring that hazardous wastes are accumulated in safe, transportable containers,
- Ensuring that hazardous wastes are stored properly to prevent possible exposure
- In addition to the guidelines for waste minimization and substitution, follow these guidelines for waste segregation:
 - Segregate waste into the following groups:
 - Halogenated solvents,
 - Non-halogenated solvents,
 - Acids,
 - Bases,
 - Heavy metals,
 - Poisons,
 - Reactives;
 - Do not mix non-hazardous waste, such as water, with hazardous waste;
 - Do not combine inorganic heavy metal waste with organic solvent waste in hazardous waste containers;
 - Double-bag dry materials contaminated with chemicals (paper, rags, towels, gloves, or kim wipes, etc) in heavy-duty plastic bags,
 - Do not use biohazard bags,
 - Dispose of these items in the same manner as hazardous waste;
 - Encapsulate sharps (eg, needles, razor blades, etc) then place them in trash dumpsters.
- Special Concerns:

Employees who generate hazardous waste must maintain and control their hazardous waste accumulation areas.

Special concerns for hazardous waste include the following:

 - Unneeded chemicals that are to be discarded must be handled and managed as hazardous waste,
 - Unknown chemical waste will be picked up by the Emergency Manager, however the College will incur additional charges for the chemical analysis to determine the proper disposal method,

If possible identify unknowns at the point of generation,
 - Gas cylinders (including lecture bottles) are extremely difficult to discard,
 - They should be returned to the manufacturer, or distributor whenever possible,
 - Cylinders that cannot be returned should be tagged as hazardous waste as soon as possible,
 - Photographic chemicals containing silver may not be placed in the sanitary sewer,
 - They must be disposed of as hazardous waste.

I. Contingency Plan and Emergency Response Procedures:

Details concerning the College's spill response procedures can be found in the Emergency Prevention and Response Manual (EPRM).

J. Resource Conservation and Recovery Act Hazardous Waste Training:

- Generator's in the departments receive specific hazardous waste training in accordance with 40 CFR26516;
- The initial training is shown in Hazardous Waste Management Program;
- Training is provided by Emergency Manager and training records are maintained by the Emergency Manager;
- Refresher training is provided by Emergency Manager annually;
- Training includes generator requirements (waste containers, labels, secondary containment, spill kits), CAA requirements, waste pickup procedures, and spill response procedures.

XIV. Agriculture Safety:

Amarillo College is not engaged in farming activities, nor does it provide agricultural education. However several of the day to day operations of Amarillo College utilize farming techniques, procedures and equipment. The employees, students and visitors to Amarillo College shall adhere to the following agricultural safety practices.

A. Pesticide Chemical Safety:

This section discusses agricultural chemical safety for pesticides, including rodenticides, insecticides, herbicides, etc. Pesticides are chemicals that protect crops and livestock from rodents, insects, disease, or weeds. They also control pests that endanger human health. Because pesticides are poisonous, they can be extremely dangerous to humans. Before applying commercial pesticides, always ensure your safety, the safety of others, and the safety of the environment.

There are several government agencies that govern the use of commercial pesticides. For more information on pesticide usage, contact one or more of the following groups: Texas Department of Agriculture, Texas Department of Health, Structural Pest Control Board, Texas Commission on Environmental Quality (TCEQ), and Environmental Protection Agency (EPA).

1. General Pesticide Safety:

The following sections provide general or specific guidelines for handling pesticides.

To help reduce the hazards associated with pesticides:

- Do not transport, mix, or use agricultural chemicals unless you can summon help, if needed;
- Keep an ample supply of water nearby to flush exposed areas, if a spill occurs ;
- Check all pesticide equipment before you use it to ensure proper working condition;
- Read pesticide labels carefully,
 - Follow the label directions when mixing, applying, storing, or disposing of pesticides;
- Wear personal protective equipment to prevent dermal, inhalation, and mucous membrane exposure;
- Do not eat, drink, or smoke when handling pesticides;
- Launder clothing and bathe after working with pesticides to ensure that all chemicals are removed from clothing and skin;
- Do not use agricultural pesticides around the home or office;
- Observe assigned reentry intervals;
- Always wear the appropriate protective clothing when entering fields before the reentry date;
- Always handle pesticides downhill from wells, cisterns, sink holes, ditches, or standing water;
- Do not apply pesticides when rain is imminent or if wind could affect the spraying area;
- Triple-rinse spray equipment and empty containers,
 - Apply the rinse water to the treated field;
- Properly dispose of empty containers;

5. Preparing to Apply Pesticides:

Preparation is essential for chemical safety.

Follow these steps to properly prepare for pesticide application:

- Plan Ahead;
- Always read chemical labels before attempting to work with pesticides;
- Prepare for a possible emergency by maintaining a personal decontamination site, a chemical spill kit, and by knowing the proper first aid procedures associated with your pesticide;
- Move Pesticides Safely,
 - Careless chemical transportation can cause spills and contamination,
 - Do not carry pesticides in an enclosed area, such as a car,
 - Be sure to secure the pesticides to prevent shifting or bouncing,
 - In addition, never leave your vehicle unattended when transporting chemicals;
- Select Appropriate Personal Protective Equipment,
 - Regardless of the pesticide's toxicity, always wear a long-sleeve

- shirt and pants when working with pesticides,
- Wear additional protective equipment, as necessary;
- Select Application Equipment,
 - Choose suitable equipment to properly apply pesticides,
 - Before using the equipment, inspect it for good working order;
- Provide Prior Notification,
 - Before applying pesticides, inform all people in or around the application area,
 - Notification allows people to protect themselves from harmful chemicals;
- Mixing Pesticides,
 - Always read and carefully follow label directions when mixing Pesticides,
 - Even if you are familiar with a particular chemical, reread the label to ensure that you have the latest safety information;
- In addition, follow these guidelines for mixing pesticides:
 - Wear Personal Protective Equipment,
 - Always wear protective gear when handling hazardous chemicals,
 - Work in a Safe Area,
 - The pesticide mixing and loading area should be well ventilated, well lighted, and downhill from any water sources,
 - Concrete slabs are ideal for mixing chemicals since they allow for easy cleanup,
 - Measure Chemicals Correctly,
 - Measure and mix pesticides carefully,
 - Never mix different pesticides except as directed by the label or chemical manufacturer,
 - Do not use more chemical than prescribed by the pesticide label,
 - The overuse of pesticides is illegal, and may result in the following:
 - Higher pest control costs,
 - Pesticide residue in food,
 - Groundwater pollution, and
 - Pesticide resistance,
 - Pour Pesticides Carefully,
 - Always wear a face shield and take care not to splash chemicals when pouring pesticides,
 - Never use your mouth to siphon pesticides.

3. Applying Pesticides:

When you apply pesticides, you are responsible for protecting yourself, other people, and the environment.

Follow these guidelines when applying pesticides:

- Minimize Exposure;
- Even mildly toxic chemicals can harm you if you use them daily;
- Take care to minimize your exposure to any chemical;
- Avoid working in pesticide spray, mist, or runoff;
- Always work with another person when working with hazardous chemicals;
- Avoid Applying Pesticides in Sensitive Areas;
- Avoid spraying pesticides near beehives or areas that humans normally occupy (eg, schools, playgrounds, hospitals, etc),
 - If you must apply pesticides in sensitive areas, do so when the weather is calm and when people are not around;
- Avoid Pesticide Drift, Runoff, and Spills,
 - Pesticides that fall outside the targeted application area can be very hazardous,
 - Choose weather conditions, equipment, and chemicals that do not lend themselves to these hazards;
- Avoid Equipment Accidents,
 - Equipment accidents are often caused by poor maintenance and improper work habits,
 - Avoid equipment accidents by following all operating instructions.

4. Pesticide Storage and Disposal:

Always try to use all the pesticide in your application tank. If pesticides remain, use them on other target locations. After emptying the tank, clean and store the equipment.

The following summary of EPA storage criteria should be followed for pesticides labeled with the signal words DANGER, POISON, or WARNING, or the skull and crossbones symbol. These procedures and criteria are not necessary for the storage of pesticides classed as less toxic (CAUTION word on the label) or for those registered for use in the home or garden.

a) Site Storage:

- Locate where flooding is unlikely;
- Locate where runoff will not contaminate any water system.

b) Storage Facility:

- Dry, well ventilated, separate room, building, or covered area with fire protection (eg, dry chemical fire extinguisher);
- Secured by fence and/or locked doors;
- Signs on rooms/buildings to provide hazard warning (eg, DANGER, POISON, and PESTICIDE STORAGE);

- Movable pesticide equipment is labeled as contaminated and Is not to be removed from the site until decontaminated.
- Provision is available for the decontamination of personnel and equipment; contaminated water disposed of as excess pesticide; contaminated runoff collected and treated as excess pesticide.

c) Operational Procedures:

- Store pesticide containers in rows with the labels plainly visible;
- Place contents from damaged containers in sound containers;
- If relevant, segregate pesticides by formulation;
- Store rigid containers in an upright position, with tight lids/bungs, off the ground, in a manner to permit access and inspection;
- Maintain a complete inventory indicating the number and identity of containers;
- Check containers regularly for corrosion and leaks;
- Keep suitable absorbent (eg, vermiculite) on hand in case of spills.

d) Safety Precautions:

- Inspect pesticide containers for leaks before handling them;
- Do not allow unauthorized personnel in the storage area;
- Do not store pesticides next to items intended for consumption by animals or humans;
- Do not eat, drink, smoke, or chew tobacco where pesticides are present;
- Do not store beverages, food, eating utensils, or smoking material in the storage or loading areas;
- Wear rubber gloves while handling containers of pesticides
- Wash hands immediately after handling pesticides;
- Remove contaminated protective clothing immediately; extra sets of clean clothing should be nearby.

e) Fire Control:

- Where large quantities are stored, inform the Physical Plant;
- The Physical Plant will furnish the College Police with home telephone numbers of responsible persons.

5. Disposal:

- Unused or outdated pesticides must be disposed as hazardous chemicals;
- See the Hazardous Waste Disposal chapter for more information.

iIMPORTANT!

Never leave pesticide containers at a field site. Be sure to account for every container used, and safely dispose of empty containers.

NOTE:

Store herbicides separately from other pesticides.

Some herbicides may volatilize and contaminate the pesticides.

6. Pesticide Cleanup:

- Always thoroughly clean all pesticide equipment as soon as you are through with it.
- Leaving pesticide residue in mixing, loading, or application equipment can result in accidental injury or death to livestock or people or unwanted contamination of plants or soil;
- Clean the inside and outside of pesticide equipment, including nozzles;
- Dispose of contaminated rinse water as directed on the chemical label.

iIMPORTANT!

Do not allow pesticide rinse water to contaminate water supplies.

7. Antidotes:

- Time is of the essence when pesticide overexposure occurs;
- However, using an antidote kit may not be the best course of action,
 - Unless a physician has stated that an antidote is needed, it should not be administered,
 - Some antidotes such as atropine can be poisonous if misused,
 - A prescription may even be necessary to acquire the antidote,
 - You may be able to get a local physician to write the prescription,
 - Prepare a written protocol regarding the use of the antidote,
 - Train pertinent employees about how and when to administer the antidote,
 - If medical assistance is available locally through a hospital, physician, or emergency medical service, you should call College Police, 371-5911 (or 5911, from a campus phone) or take the individual directly to the nearest emergency treatment center instead of maintaining an antidote kit on site.

B. Fertilizer Chemical Safety:

Ammonia fertilizers are widely used because of their effectiveness in getting large amounts of nitrogen into the soil. Anhydrous ammonia fertilizer is essentially dry ammonia gas compressed into liquid form. This material is very harmful if accidentally spilled or sprayed onto body surfaces. It can cause blindness if it gets into the eyes. Also, high concentrations of ammonia gas in the air are very irritating to the lungs.

Always use appropriate personal protective equipment and exercise rigorous care when handling, applying, and storing such toxic or irritating materials.

1. Safety Precautions:

- Most ammonia fertilizer accidents occur when the material is being transferred from one tank to another;
- One of the major causes of accidents is hoses coming loose or bursting;

Exercise care in the handling and use of ammonia fertilizer by doing the following:

- Always wear chemical goggles and adequate skin cover;
- Inspect equipment before each day's work and correct any abnormal conditions;
- Water is the first aid treatment of choice when ammonia gets into the eyes or on the skin,
 - In case of mishap, flush affected areas for 15 minutes and get medical help as soon as possible;
- Make sure all valves, lines, and connections are secure in order to reduce the chance of either leaks or being doused during transfer;
- Observe these precautions when working with anhydrous ammonia:
 - Use good equipment specially designed for handling anhydrous Ammonia,
 - Keep your equipment in good repair,
Worn hoses, loose connections, and other defects can cause accidents,
 - Follow the prescribed sequence of operations for connecting to, filling, and disconnecting from the applicator tank,
 - Never leave the equipment during the transfer operation,
 - After filling the applicator tank, close all valves;

Storing Ammonium Nitrate:

The guidelines listed below must be followed when storing ammonium nitrate fertilizer:

- Not more than 60 tons of ammonium nitrate shall be stored;
- Storage buildings shall have adequate ventilation;

- All flooring in storage and handling areas shall be of noncombustible material, without open drains or traps;
- Buildings and structures shall be dry and free from water seepage through the roof, walls, and floors;
- Bags of ammonium nitrate shall not be stored within 30 inches of the storage building walls and partitions;
- The height of piles shall not exceed 20 feet;
- The width of piles shall not exceed 20 feet or the length 50 feet;
- Aisles shall be provided to separate piles by a clear space of not less than 3 feet in width;
- Ammonium nitrate shall be stored separately from flammable or combustible materials (eg paper, rags, hay, oils);
- Broken bags, spilled material, and discarded containers shall be promptly gathered and disposed;
- Smoking is Prohibited where ammonium nitrate is stored;
- Fire control devices such as a water hose or portable fire extinguishers must be available in the storage area.

C. Tractor Safety:

New tractors are specifically designed for safe handling and operation. Older tractors are outdated and missing some of the latest standard safety features.

The following sections discuss general guidelines for tractor safety, including guards, shields, and power take-off equipment (PTOs).

1. General Equipment Safety:

- Keeping equipment in good working condition is half the formula for being safe;
- The other half is the ability and awareness of the person operating the equipment.
- $\text{Safety} = \text{Good Working Equipment} + \text{Able and Aware Operator}$;
- Equipment failure causes some farm accidents; however, most tractor accidents are caused by tired, stressed, rushed, distracted, or incompetent operators;
- In addition to the specific safe handling rules for each type of tractor, there are ten basic guidelines for tractor safety:
 - Read and comply with the operator's safety manual for each tractor,
 - Prepare for safety by wearing appropriate clothing, having enough rest, not drinking alcohol, and ensuring that all workers have been trained and are capable of safely using the tractors,
 - Keep all guards, shields, and access doors in place when a tractor is in operation,
 - Be aware of what you are doing and where you are going,
 - Adjust tractor speed to fit operating conditions,
 - Keep children and other people away from the working area,

- Take breaks from work, as necessary,
- Always stop the engine, disconnect the power source, and wait for all moving parts to stop, before servicing, adjusting, cleaning, or unclogging tractors and their equipment,
- Display the slow moving vehicle emblem on a tractor driven on public roadways,
- Allow the engine to cool before refueling.

2. Farm Field Equipment:

Farm field equipment is agricultural machinery that is normally mobile. Examples of farm field equipment include combines, tractors and their implements, including self-propelled implements. Because tractor accidents account for 500 to 600 fatalities each year, this section will focus primarily on tractor safety.

3. General Tractor Safety:

Tractor accidents are the leading cause of fatalities and accidents on Texas farms and ranches. Approximately 42% of these accidents are the result of operators being run over by tractors, 36% are due to tractor roll-overs, and 5% involve riders who fall off the tractor and are then run over by the attached trailing equipment.

The following guidelines offer general safety tips for operating tractors:

- Know your tractor and how to use it safely;
- Regularly review the safety precautions in your operator's manual;
- Prepare for tractor work by inspecting the vehicle and wearing appropriate clothing;
- Ensure that new and inexperienced workers are properly trained in tractor operation;
- Never allow riders,
 - A tractor should have only one person on board;
- No child shall be allowed to operate or use a tractor owned by or on Amarillo college property;
- Install an approved roll-over protective structure (ROPS) and seat belt on any tractor that is not equipped with these features,
 - ROPS prevent tractor turnover injuries, but only if the seat belt is worn;
- Always wear a seat belt, when driving a tractor equipped with a ROPS;
- Disengage drives and turn the engine off before leaving the tractor unattended;
- Keep yourself and others away from moving parts;
- Hitch loads only to the drawbar,
 - When using three-point rear hitches, add front end weights to maintain stability and control steering;
- Never bypass start the engine.

a) Tractor Driving Safety:

The following guidelines provide tips for tractor driving safety:

- Watch where you are going at all times,
 - Be sure everyone is out of the way before moving;
- Watch for and avoid obstacles, ditches, embankments, and holes;
- Slow down when turning, crossing slopes, or driving on rough, slick, or muddy surfaces;
- It is safer to back up an incline;
- Apply power slowly when pulling a heavy load;
- Lock the brake pedals together for single action braking;
- Tractor operators can help prevent back roll-overs as follows:
 - Only hitch loads to the drawbar,
 - Limit the height of three-point hitches,
 - Use front-end weights to stabilize heavy hauling loads,
 - Start slowly,
 - Change gears carefully;
- Tractor operators can help prevent side roll-overs as follows:
 - Increase tractor width, if possible,
 - Lock brakes together for road travel,
 - Operate tractors only as recommended,
 - Avoid steep slopes and ditches,
 - Be careful when pulling heavy loads or working with a front-end loader,
 - Turn corners slowly;

b) Roll-Over Protective Structures:

ROPS consist of cabs or frames that protect tractor operators. They are designed to prevent tractor roll-over injuries. All tractors manufactured after October 25, 1976 must have ROPS. Older tractors may be retrofitted with a ROPS obtained from the tractor manufacturer. Installing a makeshift metal bar is not sufficient to protect people from the dangers of a tractor rollover. An OSHA-approved ROPS that meets durability tests is the only real protection against rollover injuries.

The only types of tractors that do not require ROPS include the following:

- Low profile tractors used for work that would interfere with a ROPS (eg, picking orchards, vineyards, hopyards, etc);
- Tractors with mounted equipment that is incompatible with a ROPS (eg, cornpickers, cottonstrippers, fruit harvesters, etc).

c) Bypass Starting:

Bypass starting occurs when an operator "bypasses" normal safety procedures and the normal starting system. A typical bypass occurs when someone standing on the ground touches a screwdriver or other metal object to the starter contacts and activates the engine. This action avoids standard safety devices that keep the engine from starting without someone in the driver's seat.

Another method of bypass starting occurs when someone uses the starting button to start a tractor from the ground.

iImportant!

Any method of bypass starting is extremely dangerous. If the tractor is in gear when the bypass occurs, the machine will start and can injure or kill anyone in its path. This situation is even more serious if the tractor is equipped with a hydraulic clutch. If a tractor with a hydraulic clutch is bypass started, it will not move immediately, but it will lurch suddenly with the buildup of hydraulic pressure.

All tractor operators should follow these safe starting rules:

- Never start a tractor by shorting across the starter terminals;
- Keep tractors in good working order so they will start normally;
- If a tractor has a neutral start switch, but it starts in gear with the key or starter button, something is wrong,
 - Fix the tractor immediately;
- Never wire around or defeat the neutral start switch;
- Always place a tractor in neutral or park before starting it;
- Never start a tractor from the ground.

4. Hydraulic Equipment Safety:

Tractor operators must be extremely careful when working around hydraulic equipment. Hydraulic pressure is often strong enough to knock a person out if a leak or explosion occurs.

Follow these guidelines when working with hydraulic equipment:

- Inspect hydraulic equipment regularly for leaks;
- Report and fix any leaks immediately;
- Ensure that all couplings are properly installed and in good working condition;
- Ensure that all lines and fittings are in good condition;
- Repair or replace any equipment that is not in good condition;
- Lock transport wheels and support jacks on implements in place before disconnecting hydraulic cylinders,

- This action will prevent sudden shocks to the machine or personal injury;
- Keep couplings and hoses in good repair so that the hydraulic system can safely sustain maximum pressure.

5. Guards, Shields, and PTOs:

Guards and shields are extremely important because they keep operators from inadvertently contacting, or being caught, by moving machinery parts. Do Not Operate equipment with missing guards. Ensure that moving parts are guarded or shielded whenever possible. In addition, to prevent burns or fires, shield heat-producing components (eg, exhaust pipes).

Since all moving parts cannot be guarded due to their function, stay clear of these machines when they are in operation. In addition, turn these machines off if they need service, maintenance, or repair.

!IMPORTANT!

If you take guards or shields off, put them back on the machine. Replace them if they are lost or damaged. Guards and shields are absolutely essential for PTO farm equipment. Leave the master shield in place when the implement is unhitched. Replace missing or damaged shields immediately.

D. Fuel Storage:

Fuel storage is an important safety concern for Amarillo College. The following sections discuss general safety guidelines for stationary fuel storage tanks, portable fuel tanks, and liquefied petroleum gas.

1. Stationary Fuel Storage Tanks:

Petroleum products for agricultural use, including gasoline and diesel fuel, are stored in Aboveground Storage Tanks (AST) or Underground Storage Tanks (UST). The Texas Commission on Environmental Quality (TCEQ) regulates ASTs and USTs. Fuel tanks with volumes less than or equal to 1100 gallons are exempt from TCEQ requirements.

Fuel tanks with volumes greater than 1100 gallons must meet these requirements:

- Notification;
- Registration;
- Annual fees;
- Recordkeeping.

2. Portable Fuel Tanks:

Even small quantities of fuel, such as gasoline, kerosene, or diesel fuel must be properly labeled and stored. Always use DOT approved metal tanks or UL or FM labeled containers to store small amounts of fuel.

Store small portable fuel tanks in well-ventilated areas, away from other flammable materials or ignition sources. Do not use containers such as empty plastic milk jugs to store fuels. Please refer to the Chemical Safety chapter for more information on flammable materials.

iIMPORTANT!

Clearly label fuel containers to indicate contents.

3. Liquefied Petroleum Gas:

The Texas Railroad Commission regulates the sale and use of Liquefied Petroleum Gas (LPG). There are several safety considerations associated with LPG. All LPG tanks must comply with Department of Transportation (DOT) standards for storage and use.

Paint LPG tanks either white or aluminum. Locate LPG tanks away from flammable materials and possible ignition sources. In addition, ensure that ASTs have noncombustible structural supports and a firm masonry foundation so that the bottom of the tank does not touch the ground.

LPG tanks cannot be downhill from flammable liquid tanks such as gasoline or diesel. Stationary LPG tanks cannot be placed in any area beneath an electric transmission or distribution line.

LPG tanks must be equipped with hydrostatic relief valves, excess flow valves, etc, as required by the Texas Railroad Commission.

iIMPORTANT

Portable LPG containers may be used within a building; however, they must be stored in a separate location outside of the building. Refer to the Fire/Life Safety chapter for more information.

The following table provides minimum safe distance requirements for the location of stationary LPG containers:

Location Description	0-500.99 Gallons	501-2000.99 Gallons	2001-4000.99 Gallons
Ignition Source/Combustible Material	10 feet	15 feet	25 feet
Flammable Liquid Container	20 feet	20 feet	20 feet
Building	10 feet	15 feet	25 feet
Adjoining Property line	10 feet	15 feet	25 feet
Roadway, Railway, Utility Line, or Pipe Line	10 feet	15 feet	25 feet

E. Towing Safety:

When towing a trailer or farm equipment, follow these guidelines to ensure driving safety:

- Ensure that the trailer and hitching attachments meet local and state requirements;
- The trailer must have a current tag and registration;
- Inspect the trailer's wheels and the towing vehicle's wheels to ensure they are in good working order;
- Ensure that the trailer hitch is sufficiently strong and properly mounted;
- Make sure that the towing ball is the correct size for the trailer hitch;
- Always secure a safety chain between the trailer and the towing vehicle;
- Inspect all indicator lights to ensure they are working;
- Adjust mirrors as necessary to view the roadway behind the trailer;
- Adjust your speed and apply brakes evenly to allow for increased stopping distances;
- When backing a trailer, it is helpful to have another person behind the trailer to guide you,
 - Put your hand on the bottom section of the steering wheel and turn the wheel in the direction that you want the trailer to move.

XV. Radiological Safety:

The State of Texas regulates the use of radiation through the Texas Department of State Health Services - Radiation Control Program. Use of radiation devices, sources, and lasers at Amarillo College must be in compliance with the Texas Bureau of Radiation Control Program Regulations.

Amarillo College maintains strict requirements for working with sources of radiation. The radiation safety program purpose is to protect employees, students, and visitors as well as the public and the environment from the harmful effects of exposure to ionizing and non-ionizing radiations. Each Division and Department that works with or utilizes any source of radiation is required to develop a Radiation Safety Manual specific to their needs, uses and exposure. These Radiation Safety Manuals are appendices to this Safety Manual and governs the

protocol and use of radioactive materials and radiation-producing devices on campus, within their Division and Department.

Any faculty or staff member who desires to work with radioisotopes or radiation-producing devices must apply for and receive a permit from the Texas Bureau of Radiation Control and the Emergency Manager. In addition, their employees and other employees who work with sources of radiation must receive formal training in equipment operation, safety guidelines, and emergency Procedures.

A. Radioactive Materials:

- With regard to the use of licensed radioactive materials, these policies apply to sealed sources as well as to open isotopes regardless of physical or chemical form;
- Radioactive materials may only be possessed by or under the supervision of individuals who have been formally permitted by the Texas Bureau of Radiation Control and have the permission of the their Department Chair;
- Permit Holders or their designees shall obtain approval from their Department Chair before placing an order for radioactive materials. Approvals are also required before Permit Holders receive radioactive materials via transfer from another licensee, via donations, etc;
- All sources of radiation shall be secured from unauthorized access or removal;
- All radioactive wastes shall be disposed through the Emergency Manager or via written procedures approved by the Emergency Manager;
- All persons are responsible for safe working practices and for maintaining their own exposures to ionizing radiations As Low As Reasonably Achievable (ALARA);
- Each user is responsible for reporting unsafe practices and/or rules violations to the Permit Holder or, if responses are not satisfactory, to the Emergency Manager or the Texas Department of State Health Services - Bureau of Radiation Control.

Note:

Ionization type smoke detectors normally contain approximately 1 microcurie of Americium-241, an alpha emitting isotope with a 432 year half-life. Contact the Emergency Manger regarding Disposal instructions when replacing this type of smoke detector.

B. Lasers:

The State of Texas regulates the use of lasers through the Texas Department of State Health Services - Bureau of Radiation Control. Amarillo College registers, and is responsible for, the safe use of all lasers on campus.

Lasers present many safety threats, but the most common threat is damage to the eyes. Other common laser concerns include skin damage, electrical hazards from high-energy power sources, chemical exposure, fire/explosion hazards, and exposure to cryogenic materials such as hydrogen and oxygen. Many lasers emit invisible ultraviolet or infrared radiation.

Lasers are classified into four basic categories as indicated below:

Class 1:

- Lowest power lasers that do not emit hazardous levels

Class 2:

- Low power visible light lasers that pose a hazard only if viewed directly for extended periods.

Class 3a:

- Intermediate power lasers that would not normally cause injury to the eye unless viewed with collection optics.

Class 3b:

- Medium power lasers that pose moderate risk and can cause injury.

Class 4:

- High energy, high-risk lasers that can cause injury to the eyes and skin from direct or diffused reflection.

NOTE:

If you work with a class 3b or 4 laser, you must obtain a Laser Permit from the Emergency Manager.

Laser devices require engineering controls to ensure safety. All Class 3 and 4 lasers require a combination of protective housing, area warning signs or remote firing capabilities.

The following information is required for obtaining a laser permit:

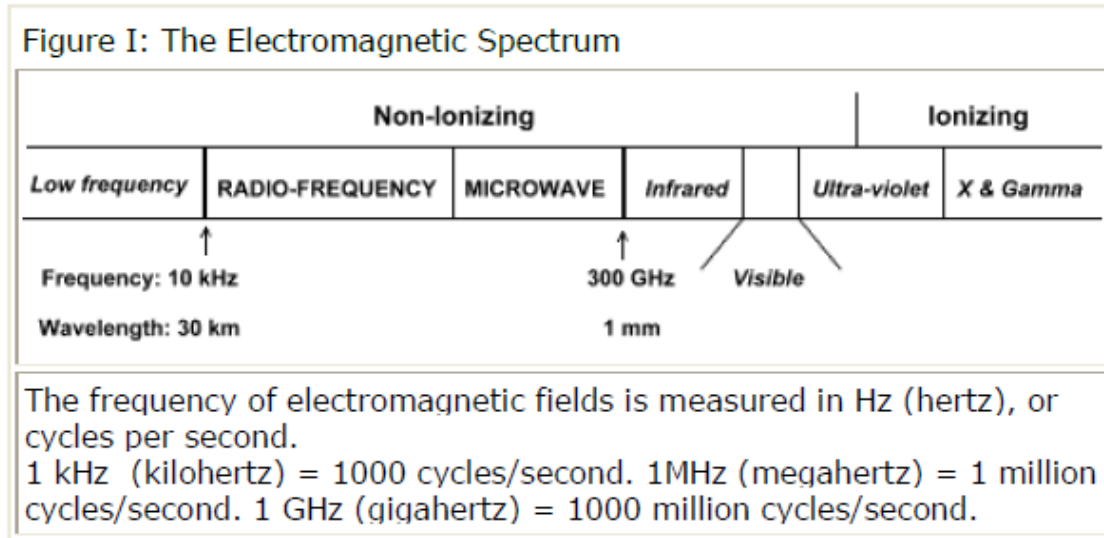
- Classification of the laser device;
- Wavelength of the laser output;
- Power output;
- Appropriate eyewear.

Follow these guidelines when working with Class 3b and 4 lasers:

- Never aim a laser at a person;
- Be very careful when working with hand-held laser pointers;
- Do not allow children access to pointers;
- Wear protective clothing such as eyewear and skin protection as appropriate;
- Post warning signs at entrances where lasers are present;
- When working with power supplies, remove jewelry, stand on a dry surface, and work with only one hand at a time. Observe high voltage precautions (see Electrical Safety chapter);
- Control access to areas where lasers are used (ie, no spectators);
- If possible, enclose the entire laser beam path on Class 4 lasers.

C. Radiofrequency Radiation (RF):

"Radiofrequency (or RF) Radiation" refers to electromagnetic fields with frequencies between 300 kHz and 300 MHz, while "Microwave (or MW) Radiation" covers fields from 300 MHz to 300 GHz. Since they have similar characteristics, RF and MW radiation are usually treated together. As well, the lower-frequency boundary of RF radiation is often extended to 10 kHz, or even to 3 kHz, in order to include emissions from commonly used devices.



The preceding paragraph describes the image.

RF radiation is produced by devices such as radio and TV transmitters, induction heaters, and dielectric heaters (also known as RF sealers). MW radiation is produced by microwave ovens, parabolic (dish) antennas, radar devices, and diathermy applicators.

Federal legislation requires that microwave ovens be constructed to meet stringent microwave leakage limits and to have safety interlocks. When these interlocks are defeated, for example, during repair work, there is a risk of overexposure to microwave radiation.

This guide gives advice on preventing overexposure to RF/MW radiation in the workplace. However, this guide cannot cover all possible situations. The requirements set out in the Occupational Health and Safety Act must be complied with, and they should be referred to when this guideline is used.

1. Health Hazards:

The nature and the degree of the health effects of overexposure to RF/MW fields depend on the frequency and intensity of the fields, the duration of exposure, the distance from the source, any shielding that may be used, and other factors.

The main effect of exposure to RF/MW fields is heating of body tissues as energy from the fields is absorbed by the body. Prolonged exposure to strong RF/MW fields may increase the body temperature, producing symptoms similar to those of physical activity. In extreme cases, or when exposed to other sources of heat at the same time, the body's cooling system may be unable to cope with the heat load, leading to heat exhaustion and heat stroke.

Localized heating, or "hot spots," may lead to heat damage and burns to internal tissues. Hot spots can be caused by non-uniform fields, by reflection and refraction of RF/MW fields inside the body, or by the interaction of the fields with metallic implants, for example, cardiac pacemakers or aneurism clips. There is a higher risk of heat damage with organs which have poor temperature control, such as the lens of the eye and the testes.

Other hazards include contact shocks and RF burns. These can result from the electric currents which flow between a conducting object and a person who comes into contact with it while they are exposed to RF fields (These effects should not be confused with shocks from static electricity).

Some laboratory studies have reported biological effects from RF/MW radiation at field levels which are too low to cause tissue heating. To date, these non-thermal effects are not known to result in health hazards. Although we are constantly exposed to weak RF fields from radio and television broadcasting, no health risks have been identified from this low-level exposure.

Recent reports suggesting a relationship between either cellular telephone or traffic radar use and cancer have not been substantiated.

2. Controlling RF/MW Radiation:

a) Engineering Controls:

- Sources of RF/MW radiation should be properly shielded to minimize stray radiation;
- Devices which can produce acute thermal injuries (eg, industrial MW ovens) should have interlocked doors;
- Devices which produce high levels of stray RF radiation (eg, induction heaters and dielectric heaters) should be operated remotely whenever possible.

b) Administrative Controls:

- Exposure of workers to RF/MW Radiation should not exceed the recommended exposure limits;
- Areas where worker exposure to RF/MW Radiation is suspected to exceed the recommended limits should be surveyed to determine the exposure levels;
- Needless exposure to RF/MW fields should be avoided;
- Exposure times should be kept as short as reasonably possible;
- Potentially hazardous RF/MW devices should be appropriately labeled, and areas of excessive exposure around them clearly demarcated Notices with warnings and the necessary precautions should be posted;
- Electrically-activated explosive devices should not be placed near sources of RF/MW radiation;
- RF/MW devices should not be used in flammable or explosive atmospheres;
- Equipment sensitive to RF/MW radiation, such as telephone switchboards or control panels, should not be installed near sources of RF/MW radiation;
- Maintenance of devices used to produce RF/MW radiation should be done by qualified personnel following standard safety procedures;
- The equipment should be turned off whenever possible.

c) Personal Protection:

- When exposures cannot be reduced by the above methods, RF/MW protective suits, including head and eye protection, can be used;
- Suits should be tested to ensure that they reduce worker exposure to levels below the occupational exposure limits and that they do not pose any safety hazards (eg, overheating, shocks, or fire).

3. Controlling RF Shocks and Burns:

- Metallic structures producing contact shocks should be electrically grounded and/or insulated;
- Insulating platforms or shoes (eg, rubber-soled shoes) can be used to reduce energy absorption and currents to ground;
- When the above measures are ineffective or not reasonably possible, workers should wear insulating gloves.

4. First Aid:

- Remove worker from exposure area to a cool environment and provide cool drinking water;
- Apply cold water or ice to burned areas;
- Seek immediate medical attention;
- Severe MW or RF overexposure may damage internal tissues without apparent skin injury, so a follow-up physical examination is advisable.

D. Microwave Ovens:

Metal reflects microwave radiation, but dry nonmetallic surfaces allow microwaves to pass through with little or no heating effect. Organic materials, however, are extremely heat conductive. Because microwaves can penetrate organic materials, including tissues, thermal burns and other effects may result from microwave exposure.

NOTE:

Microwave ovens are very safe when kept in good working condition And used properly. They do not serve as a source of exposure to Harmful microwaves.

- Even though microwave ovens are not a source of harmful radiation exposure, they should be properly used and maintained;
- Do not put metal objects (including aluminum foil) into a microwave oven;
- Do not use a microwave oven if it is damaged;
- Ensure that the seal on a microwave oven is tight, intact, and in good condition (ie, not charred or distorted);
- Ensure that microwave ovens are clearly labeled for laboratory use or food preparation only;
- Microwave ovens should only be repaired by trained personnel.

E. Radiation-Producing Devices:

Radiation-producing devices such as X-ray machines and particle accelerators are regulated through the Texas Department of State Health Services – Bureau of Radiation Control. All radiation-producing devices must be registered with the Amarillo College Emergency Manager. Each Department with and x-ray producing device must develop safety procedures and protocols for the safe utilization of x-ray producing devices on an Amarillo College campus.

These safety procedures and protocols are to be included as an Appendix to this Safety Manual.

Radiation-producing devices (other than human diagnostic devices) shall be interlocked to prevent access to the unshielded beam during normal or routine operations. Exceptions may be granted by Amarillo College on a case by case basis.

!IMPORTANT!

The door(s) to a room where a radiation-producing device is located should be posted with a radiation warning sign, unless the device is totally self-contained.

F. Ultraviolet Lamps:

Ultraviolet (UV) lamps are useful germicidal tools, but they also pose a potential health hazard. The following sections provide essential safety information for working with UV lamps and light.

1. Health Hazards:

Exposure to UV radiation can cause extreme discomfort and serious injury. Therefore, you must protect your eyes and skin from direct and reflected UV light. Pay particular attention to laboratory surfaces, such as stainless steel, that can reflect UV light and increase your UV exposure.

The effect of UV radiation overexposure depends on UV dosage, wave length, portion of body exposed, and the sensitivity of the individual. Overexposure of the eyes may produce painful inflammation, a gritty sensation, and/or tears within three to twelve hours. Overexposure of the skin will produce reddening (ie, sunburn) within one to eight hours. Certain medication can cause an individual to be more reactive to UV light.

2. Personal Protective Equipment:

Adequate eye and skin protection are essential when working around UV radiation. Before entering a laboratory with ultraviolet installations, you must turn off the lights or wear protective equipment (eg, goggles, cap, gown, and gloves).

NOTE:

Safety glasses with side shields or goggles with solid side pieces are the only equipments that provide adequate eye protection against direct and reflected UV light.

3. Germicidal Function:

UV radiation is particularly useful in the laboratory when combined with other methods for decontamination and disinfection. UV radiation is used primarily to reduce the number of microorganisms in the air and on surfaces. It is most effective against vegetative bacteria. UV rays can only kill organisms that are invisible to the naked eye. To be effective, UV rays must directly strike the microorganisms. If microorganisms are shielded by a coating of organic material (eg, culture medium), the UV light will be ineffective.

4. Maintenance:

Ultraviolet lamps lose germicidal effectiveness over time and may need to be replaced even though the lamp has not burned out. It may be necessary to replace the lamp according to the manufacturer's recommendations. There are two types of UV lamps – hot cathode and cold cathode. The hot cathode lamp has two pins at each end, and the cold cathode lamp has one pin at each end. Manufacturers recommend that hot cathode lamps should be replaced every six months and that cold cathode lamps should be replaced every 12 months.

In addition to replacing UV lamps as indicated above, follow these guidelines to maintain UV lamps:

- Regularly wipe cool, unlit UV lamp bulbs with a soft cloth moistened with alcohol (Dust can decrease the effectiveness of a UV lamp);
- Do not touch a UV bulb with your bare hands. The natural oils on your hand may leave a fingerprint and create dead space on the bulb's surface.

XVI. Vehicle Safety:

Motor vehicle accidents are the leading cause of death and crippling injury in the United States. Traffic safety laws are important components of vehicle safety, but the most important aspect of vehicle safety is the driver.

!IMPORTANT!

All Amarillo College employees who operate a motor vehicle for College business (whether a college vehicle, rental vehicle, or personal vehicle) must possess a valid state driver's license for their vehicle's class.

College Police is responsible for regulating moving vehicles and bicycles on College property.

To ensure driving safety, follow these driving practices:

- Never drink alcohol and drive,
 - Driving while under the influence of alcohol or drugs is strictly prohibited;
- Obey all traffic laws, signs, and signals;

- Respond to dangerous driving conditions as appropriate;
- Maintain a safe distance between your car and any car in front of you,
 - Allow at least one car length for each 10 MPH (eg, three car lengths if you are driving 30 MPH);
- Keep your eyes moving to avoid fatigue, especially if you plan on driving for a long period;
- Always use your turn signal to indicate your intended action;
- Leave yourself an "out" by either driving in the lane with a shoulder, driving in the middle lane of a multi-lane road, or following other vehicles at a safe distance.
- Never text or use a cell phone while driving a college vehicle, whether the vehicle is on the road or off road.

A. Defensive Driving:

By taking defensive driving courses, employees can promote driving safety and lower their insurance rates.

The principles of defensive driving include the following:

- Knowledge:
 - Know your vehicle and know the law;
- Control:
 - Always maintain control of your vehicle,
 - To improve your control, perform routine vehicle maintenance and respond to road conditions as appropriate;
- Attitude:
 - Be willing to obey all laws and be willing to yield to all other vehicles and Pedestrians;
- Reaction:
 - Respond to driving conditions appropriately,
 - Do not impede your reaction time by driving when tired or under the influence of alcohol or drugs;
- Observation:
 - Be aware of potential accidents and take preventive measures,
 - Always try to anticipate the actions of other drivers;
- Common Sense:
 - Do not risk your safety to save time,
 - Do not respond to rude or obnoxious drivers by violating traffic laws.

B. Backing Vehicles:

Backing a large vehicle can be very difficult. Try to avoid backing whenever possible.

If you must back a vehicle, follow these guidelines:

- Get out of the vehicle and inspect the area you want to back into;
- If possible, have someone outside help guide your vehicle into position;
- If your vehicle does not automatically sound a horn when in reverse, sound the horn once before moving backwards;
- Back slowly and check your mirrors often;

C. Accidents:

If you are ever involved in a vehicle accident, follow these guidelines:

- Check for injuries,
 - If anyone is injured, immediately call College Police 371-5911 (5911 from a College telephone) they will call EMS;
- If there are no injuries, you are blocking traffic, and your car can be driven, move the car to a safe location nearby (If the accident occurs on a freeway lane, ramp, shoulder, median, or busy metropolitan street, you must move your car if it is safe and possible to do so);
- If you cannot move your car, try to warn oncoming traffic to prevent other accidents:
 - Raise your hood,
 - Turn on your hazard lights,
 - Light flares;
- Exchange the following information with other drivers involved in the accident:
 - Name, address, and phone number,
 - Vehicle identification number, license number, and description,
 - Insurance information,
 - Driver's license number;
- Call the police in the following circumstances:
 - Someone is injured,
 - A car cannot be moved,
 - A driver is intoxicated,
 - A driver has no insurance,
 - A driver leaves the scene of the accident without exchanging information.

D. Railroad Crossings:

Compared with other types of collisions, train/motor vehicle crashes are 11 times more likely to result in a fatal injury. On the average, there are more train-car fatalities each year than airplane crashes. Unfortunately, driver error is the principal cause of most grade crossing accidents. Many drivers ignore the familiar tracks they cross each day, and some drivers disregard train warning signals and gates.

All public highway-rail grade crossings are marked with one or more of the following warning devices:

- Advance Warning Signs:

Advance warning signs indicate that a railroad crossing is ahead. These signs are positioned to allow enough room to stop before the train tracks.

- Pavement Markings:

Pavement markings may be painted on the pavement in front of a crossing. Always stay behind the stop line when waiting for a passing train.

- Crossbuck Signs:

Railroad crossbuck signs are found at most public crossings. Treat these signs as a yield sign. If there is more than one track, a sign below the crossbuck will indicate the number of tracks at the crossing.

- Flashing Lights and Gates:

Flashing lights are commonly used with crossbucks and gates. Stop when the lights begin to flash and the gate starts to lower across your lane. Do not attempt to cross the tracks until the gate is raised and the lights stop flashing.

!IMPORTANT!

You must stop at least 15 feet from a train track when:

(1) warning lights flash;

(2) a crossing gate or flag person signals an approaching train;

(3) a train is within 1500 feet of the crossing; or

(4) an approaching train is plainly visible and in hazardous proximity.

Follow these guidelines when you encounter a railroad crossing:

- Always expect a train;
- When approaching a crossing, LOOK, LISTEN, and LIVE;
- Be sure all tracks are clear before you proceed,
 - Remember, due to their large size, it is easy to misjudge the speed and distance of an oncoming train,
 - If you have any doubts, stop and wait for the train to pass;
- Watch for vehicles, such as school buses, that must stop before train tracks;
- Never race a train to a crossing;
- Always stop for flashing lights, bells, and gates,

- Never drive around a gate (State law requires pedestrians to stop when a railroad crossing gate is down);
- Do not allow yourself to be boxed in on a track with cars in front and behind you;
- Never stop on train tracks;
- If your car stalls on train tracks, call 911 immediately,
 - If a train approaches, abandon the car and run away from the tracks;
- When driving at night, look low to the ground for moving trains (One third of all train-car collisions occur at night when cars run into moving trains);
- Watch out for a second oncoming train after the first train has passed.

E. Bicycle Safety:

Each year there are 700 fatalities and 39,000 injuries among cyclists in the US. Cyclists must take precautions when driving on city and College streets.

Follow these safety precautions when riding a bicycle:

- Always obey all traffic laws:
 - Stop at stop signs,
 - Ride in the correct direction on one-way streets;
- Stop at railroad tracks when the warning signals are operating;
- When riding with other cyclists, ride single file in traffic;
- When bike lanes are available, use them,
 - If bike lanes are not available, stay as far right as possible on the street pavement,
 - Watch for opening car doors, sewer gratings, debris, etc,
 - Do not ride on sidewalks;
- Use hand signals when turning or changing lanes;
- Wear a helmet that is approved by ANSI or the Snell Memorial Foundation (Head injuries account for 75% of all cycling fatalities);
- If riding at night, make sure your bicycle has reflectors on the rear, front, spokes, and pedals. Wear bright, reflective clothing.

XVII. General Lawn Safety:

Amarillo College spends considerable time, effort, and money on grounds maintenance. From flower care, to lawn care, tree trimming, and leaf blowing, Amarillo College employees are responsible for safely maintaining the grounds on campus. Gardening tools and mechanical lawn care devices, such as lawn mowers, power blowers, and chain saws, present special safety concerns for grounds maintenance personnel.

Common landscaping accidents include the following:

- Cuts, lacerations, or amputations from whirling mower blades,

- Bruises or broken bones from flying projectiles;
- Burns from hot equipment parts;
- Electrical shock from faulty grounding or defective electrical cords;
- Back strain from improper equipment usage;
- Slips, trips, and falls.

Regardless of the type of landscape equipment you use, follow these basic guidelines to ensure optimum safety:

- Read the equipment owner's manual;
- Use the right equipment for the job at hand;
- Inspect the equipment before each use;
- Know how to control and stop the equipment quickly;
- Wear personal protection equipment, as necessary:
 - Eye protection,
 - Hearing protection,
 - Long pants,
 - Sturdy shoes,
 - Work gloves,
 - Apply sunscreen to exposed areas of skin,
 - Be careful to avoid fatigue and heat stress (refer to the General Safety chapter in this manual for more information),
 - Drink plenty of water,
 - Take breaks,
 - Do not operate powered equipment if you are tired, sick, or taking medication,
 - Take special precautions when working with electrical equipment,
 - If you are using an extension cord, take care not to accidentally cut it,
 - Do not smoke around gas powered equipment,
 - Allow hot equipment to cool before refueling,
 - Make sure that all guards are in place and in good condition.

!IMPORTANT!

Keep pedestrians and bystanders at least 30 feet away when using powered equipment.

A. Hand Tools:

Although garden hand tools tend to be safer than powered equipment, common gardening tools, such as rakes, shovels, and hoes cause thousands of injuries each year.

Follow these guidelines for using garden hand tools:

- Keep hand tools in good condition,
 - Replace split or rotten handles,

- Keep blades sharp;
- Buy quality tools that fit your needs and your build,
 - For example, if you are tall, choose tools with handles that are long enough to prevent you from stooping over your work;
- Never leave a rake, shovel, or hoe on the ground facing up,
 - Foot injuries from exposed metal and head injuries from handles that pop up unexpectedly are the main hazards associated with these tools.

B. Mower Safety:

Mowers are the most common type of lawn care equipment. To avoid injury with power mower equipment, you must pay close attention to your surroundings.

Whether you use a riding mower or a walk-behind mower, follow these guidelines for lawn mower safety:

- Conduct a premowing inspection of the lawn and remove any debris, rocks, limbs, or other items that could become a projectile,
 - Look for concealed hazards such as holes;
- Keep hands and feet away from moving blades;
- Fill the tank with gas before beginning work (By filling the tank initially, you can avoid having to fill the tank later when it is hot);
- Replace loud or faulty mufflers;
- Shut off the engine before unclogging, servicing, or adjusting the mower and before removing the grass bag,
 - For added protection, remove the ignition wire before working on the machine.

1. Riding Lawn Mowers:

In addition to the general guidelines for mower safety, follow these guidelines for riding lawn mower safety:

- Before starting the engine, make sure the transmission is out of gear and the mower blade clutch is disengaged;
- Never allow extra riders on the lawn mower;
- Slow down when turning and when working on slopes;
- Mow up and down slopes rather than across them;
- Always look behind you before backing;
- If you hit a large rock or stump, stop the mower and inspect the blades and shaft,
 - Replace damaged blades;
- Never leave a running lawn mower unattended,
 - Before leaving the seat, park the mower on a flat area, disengage the mower blades, and remove the ignition key.

2. Walk-Behind Mowers:

In addition to the general guidelines for mower safety, follow these guidelines for walk-behind mower safety:

- Wear sturdy shoes with good traction,
 - Never wear sandals around walk-behind mowers;
- Do not bypass the safety device that stops the blade when the operator releases his/her grip on the handle;
- Mow across slopes rather than up and down slopes;
- Work slowly and patiently when mowing tall grass or tough weeds,
 - Forcing the mower may cause repeated clogs and engine stalls;
- Never leave a running mower unattended,
 - If you stop momentarily, cut the throttle to idle and make sure the mower will not roll away.

C. Chain Saw Safety:

Chain saws are ideal for trimming trees and cutting fallen limbs into smaller pieces. Unfortunately, chain saws are associated with many serious injuries each year.

Common chain saw hazards include the following:

- Chain cuts;
- Falling trees and limbs;
- Strains and sprains;
- Burns.

To avoid injury, you must respect chain saw hazards and handle chain saws skillfully.

In addition to general lawn safety guidelines, follow these instructions for safely using chain saws:

- Stay alert while sawing,
 - Most injuries occur below the waist when the operator is not paying attention;
- Do not use a chain saw alone,
 - Have someone else stand nearby in case of an emergency;
- Choose and inspect your chain saw carefully:
 - Use the correct size chain saw for the job at hand,
 - Ensure that the chain is sharp and the tension is taut,
 - Ensure that smaller chain saws have a safety tip to prevent kickbacks (Kickbacks cause one third of all chain saw injuries),
 - Wear a hard hat to protect you from falling limbs,

- Always operate a chain saw with two hands,
- Limbs that are at shoulder height or higher present a special safety problem,
Use a ladder so that the saw is at a lower and safer position relative to your body,
- Never allow the tip of a running chain saw to touch the ground,
This could cause a serious kickback injury,
- To avoid kickback injuries; stand to the side of a running chain saw,
Do not stand directly behind it,
- Move brush and limbs as you work to maintain a clear operating area,
- Never force a chain saw through a limb,
- Never stand on a log or limb while cutting it.

D. Power Blowers:

Because power leaf blowers produce air gusts up to 200 mph, you must follow all manufacturers' safety precautions. Always walk towards your work when using a power leaf blower. Do not back away from your work.

E. Trimming Equipment:

Follow these safety guidelines for trimming equipment such as hedge trimmers, string trimmers, grass shears, and edgers:

- Avoid touching rocks, debris, and gravel with trimming equipment,
 - These items could cause a serious injury if a kickback occurs;
- Make sure all screws and chains are tight,
 - Vibrating equipment can cause screws to loosen;
- Walk towards your work,
 - Do not back away from your work when using a trimmer.

F. Chemical Products:

Information on the safe use of pesticides (insecticides, herbicides, etc) and fertilizers is given in Chapter 14, Agriculture Safety, of this manual.