2

Attribution corrections completed all changes are Green highlighted

Safety in Industry

Objective

The learner will be able to:

- **Identify protective equipment used in industry**
- **Demonstrate appropriate housekeeping skills**
- **Practice proper handling and lifting techniques**
- **Summarize lockout/Tagout procedures**
- **Describe MSDS and its use**
- **Categorize the four classes of fires**

Orienting Questions

- ✓ What are some examples of protective equipment?
- ✓ How does housekeeping relate to safety in industry?
- ✓ What is the purpose of MSDS (Material Safety Data Sheets)?

Helpful Tips

- ✓ You can select the **HIGHLIGHTED TERMS** to read more about it.
- ✓ If needed, there are **CLOSED CAPTION** buttons CC on the YouTube videos that will enable you to read along while you watch. The Closed Caption buttons are located bottom right of the video screen.
- ✓ Take time and explore about the subject by selecting the **EXPLORE** links in each section of this module.

2.1. INTRODUCTION

Safety is always a major concern when working in an industrial setting. In machining there are general and specific safety guidelines. These guidelines are in place to ensure the employees safety and security. The machine shop can be a very dangerous place. There is a great deal of equipment that can cause serious injury or death. It is crucial that safety comes first in every industrial setting.

2.1.1. GENERAL SAFETY

When working in a machine shop danger could be in the places you least expect it. There are rules that are common for every shop that will ensure every employee's safety. Machinists work around heavy equipment and material. They are also working closely with sharp cutting tools. Because of these potential dangers, no horseplay of any type is ever tolerated. Pushing, shoving, startling others, and running are examples of actions that can result in your termination (see **Figure 1**).

Other common guidelines:

- Never operate machinery that you have not been trained on.
- Always stop the machine before making any adjustments or measurements.
- Never leave a machine while it's running.
- Always lift with your legs and your back straight.
- If the object being lifted is too heavy or long, use a partner to help lift.
- Do not operate machinery under the influence of alcohol or medications that would impair your ability.
- Always follow company policy concerning first aid and emergency procedures.

It is always important to maintain focus and concentration when operating machinery. You never want to distract co-workers from the task they are performing. It only takes a split-second for an accident to happen that can result in severe injury or death.

Explore: General Safety Rules

Figure 1: Workplace Safety (Wes Pelletier, Slideshare, 2013)

2.1.1.1. REGULATION OF SAFETY

Safety is the most important part of industry. Employees always need to be mindful of proper safety practices within industry. There are entities that have been created to regulate safety in the workplace for the worker but also the company. These entities were put into place by the federal government to ensure that safety regulations are followed. If a violation occurs, a company may be subject to fines and penalties.

OSHA,, the **Occupational Safety and Health Administration**, is a federal agency that was implemented to enforce safety in the workplace. OSHA will perform on-site evaluations from time to time to ensure that the company is following their strict safety guidelines.

NIOSH, the **National Institute for Occupational Safety and Health**, is a federal agency that conducts research and makes recommendations to prevent injuries and illness at work. NIOSH does not enforce any regulations. This organization only assesses work related hazards and makes recommendations on prevention.

2.1.2. FIRE SAFETY

Fire safety is always important in any situation. In machining or an industrial setting, fire safety is part of the everyday work environment. Fire prevention is the main goal of fire safety. Assessing fire hazards is also a very important component of fire safety.

Fire has to have certain elements to burn. There are three elements that cause a fire to burn. Heat, oxygen, and fuel in combination will start and sustain any fire. Removal of any of the three will extinguish the fire. Fire extinguishers cool the fuel, remove the oxygen, or stop a reaction. With the proper extinguisher any fire can be controlled. **P.A.S.S.** (**see Figure 2 and 3**) is an acronym that is used in industry for workers to remember how to properly operate a fire extinguisher.

P.A.S.S. is an acronym for…

- **Pull**
- **Aim**
- **Squeeze**
- **Sweep**

Explore: Fire extinguisher PASS System

Figure 2: Fire Extinguisher PASS system (YouTube, 2013)

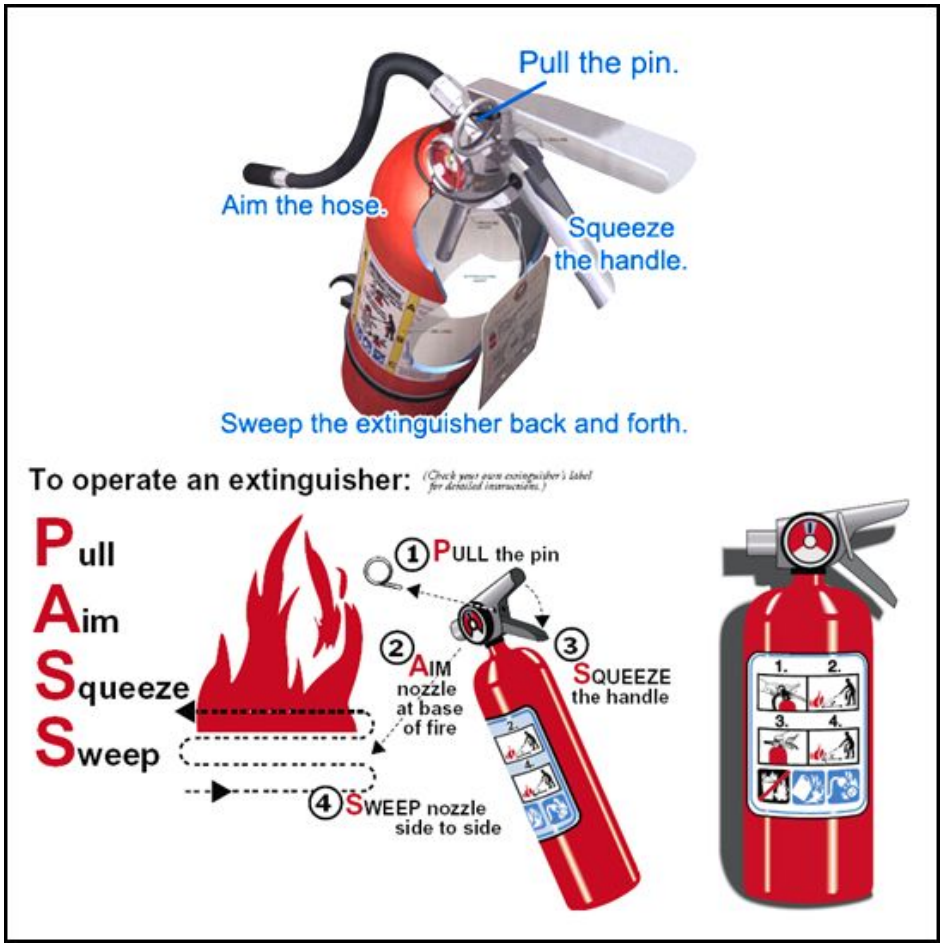


Figure 3: P.A.S.S. Fire Extinguisher Acronym (Port Ludlow Fire & Rescue www.plfr.org, 2013)

OSHA identifies fires and extinguishers by class. Class A fires are those that involve paper, cloth, wood, rubber and plastics. Class A extinguishers are water-based. Class B fires are those that start form fuels, solvents, and other flammable liquids. Class B extinguishers are carbon dioxide based. Class C fires are classified as anything electrical and the extinguisher used is a dry powder type. Class D fires are started from combustible metal particles such as magnesium, titanium, potassium, and sodium. Class D will be extinguished with the dry powder type. It is important to know what type of media is being used to extinguish a fire within these classes. Without the proper extinguisher you may amplify the fires intensity.

2.1.3. LOCKOUT/TAGOUT

In machining there are occasions that a machine tool will need maintenance or repair. To ensure the safety of the maintenance technicians and the machinists that operate the equipment, OSHA requires industry to use a system called **LOCKOUT/TAGOUT**. Lockout/Tagout is used to disable equipment from operation and employs the use of locks and tags.

The tags will have information about the repair being done. It will also have the date and the maintenance technician's name. The lock and the tag are installed by whoever is performing the repair and the key for the lock will remain with that technician until the machine is operational. Tags and locks are applied to the main power switch in the off position. Multiple tags may be added depending on the tasks required to make the machine operational. The departments involved can range from the machine shop to engineering. Unauthorized removal of tags or locks can result in severe injury and/or termination of employment.

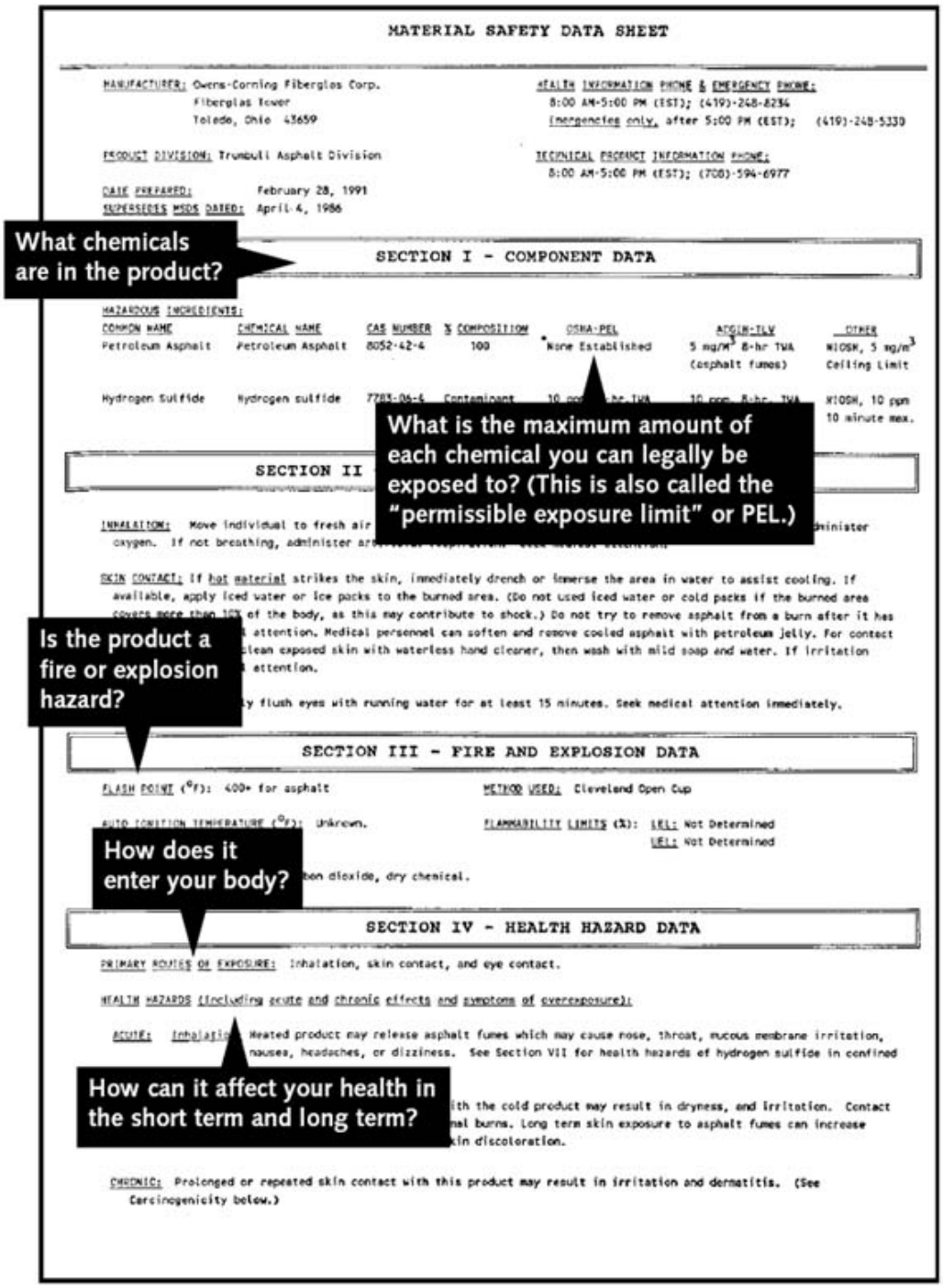
Explore: Lockout Tagout (LOTO)

2.1.4. MSDS

MSDS stands for *Material Safety Data Sheet*. These documents contain important information about the hazards products that are used by the company you are employed with. They are usually stored in a notebook in a central location that is constantly accessible to the worker. Information contained in these documents is constantly changing and should be routinely updated by a safety coordinator. This will ensure that the workers are informed about the health hazards of products they are exposed to. MSDS documents also contain important first aid guidelines if workers are exposed to an unhealthy level.

The type of information found in MSDS is the manufacturers name and their contact information, hazardous components, physical/chemical characteristics, fire and combustible data, health hazards, and precautions for handling and use (see **Figure 4**). Regular safety meetings are conducted to inform the workers of the hazards they may face on the job and the changes made to any of the MSDS data.

Explore: What does a Material Safety Data Sheet look like?



MATERIAL SAFETY DATA SHEET

MANUFACTURER: Owens-Corning Fiberglas Corp.
Fiberglas Tower
Toledo, Ohio 43659

HEALTH INFORMATION PHONE & EMERGENCY PHONE:
8:00 AM-5:00 PM (EST); (419)-248-8234
Emergencies only, after 5:00 PM (EST); (419)-248-5330

PRODUCT DIVISION: Trumbull Asphalt Division

TECHNICAL PRODUCT INFORMATION PHONE:
8:00 AM-5:00 PM (EST); (708)-594-6977

DATE PREPARED: February 28, 1991
SUPERSEDES MSDS DATED: April 4, 1986

SECTION I - COMPONENT DATA

HAZARDOUS INGREDIENTS:

COMMON NAME	CHEMICAL NAME	CAS NUMBER	% COMPOSITION	OSHA-PEL	ACGIH-TLV	OTHER
Petroleum Asphalt	Petroleum Asphalt	8052-42-4	100	None Established	5 mg/m³ 8-hr TWA (asphalt fumes)	NIOSH, 5 mg/m³ Ceiling Limit
Hydrogen Sulfide	Hydrogen sulfide	7783-06-4	Contaminant	10 ppm 8-hr TWA	10 ppm 8-hr TWA	NIOSH, 10 ppm 10 minute max.

SECTION II

INHALATION: Move individual to fresh air ... oxygen. If not breathing, administer ... minister

SKIN CONTACT: If hot material strikes the skin, immediately drench or immerse the area in water to assist cooling. If available, apply iced water or ice packs to the burned area. (Do not used iced water or cold packs if the burned area ... of the body, as this may contribute to shock.) Do not try to remove asphalt from a burn after it has ... attention. Medical personnel can soften and remove cooled asphalt with petroleum jelly. For contact ... clean exposed skin with waterless hand cleaner, then wash with mild soap and water. If irritation ... attention.

... flush eyes with running water for at least 15 minutes. Seek medical attention immediately.

SECTION III - FIRE AND EXPLOSION DATA

FLASH POINT (°F): 400+ for asphalt METHOD USED: Cleveland Open Cup

AUTO IGNITION TEMPERATURE (°F): Unknown. FLAMMABILITY LIMITS (%): LEL: Not Determined UEL: Not Determined

... bon dioxide, dry chemical.

SECTION IV - HEALTH HAZARD DATA

PRIMARY ROUTES OF EXPOSURE: Inhalation, skin contact, and eye contact.

HEALTH HAZARDS (including acute and chronic effects and symptoms of overexposure):

ACUTE: Inhalation: Heated product may release asphalt fumes which may cause nose, throat, mucous membrane irritation, ... nausea, headaches, or dizziness. See Section VII for health hazards of hydrogen sulfide in confined ...

... ith the cold product may result in dryness, and irritation. Contact ... nal burns. Long term skin exposure to asphalt fumes can increase ... kin discoloration.

CHRONIC: Prolonged or repeated skin contact with this product may result in irritation and dermatitis. (See Carcinogenicity below.)

Figure 4: Reading Material Safety Data Sheet (MSDS) (Image provided by elcosh.org, 2013)

ACTIVITY #1

Search the Internet for MSDS information on remover, cleaner and thinner agents. Write a report explaining the Signs & Symptoms of over exposure and First Aid procedure.

2.2. PERSONAL PROTECTIVE EQUIPMENT

PERSONAL PROTECTIVE EQUIPMENT (PPE) is safety equipment used and required to protect the worker in industrial environments. It protects the person from the potential dangers in the shop or plant (see **Figure 5**). PPE is not limited to a working environment. It should be practiced and worn in every situation including the home. For example, if you were cutting wood with a circular saw at home, eye protection should be worn. PPE should be observed even with something as simple as using a hammer to drive a nail.

Safety with PPE is extremely important but so is what you wear to work. There are guidelines that you should follow if your company does not designate uniforms to be worn.

- Loose fitting clothing should not be worn. It is easily caught in moving machinery.
- Jewelry of any kind is prohibited in machine shops and many manufacturing facilities. This can also be caught in moving equipment.
- Long hair should be put up to prevent it from being caught and ripped out.
- No gloves should ever be worn around moving machinery.

Explore: PPE
PPE - instructor video

Figure 5: Personal Protective Equipment (Gardner Business Media, 2013)

2.2.1. EYES

EYE PROTECTION is the most common piece of PPE that is used. In machining, hot chips and debris are often being ejected from the material that is being cut in the machine. This debris can be extremely hot and the machinist will receive burns if the chips hit their bare skin. Severe injury can occur if eye protection is not worn in these situations. Your sight is a gift and should be protected.

Safety glasses with side shields are worn to prevent these hazards. These types of glasses should meet industry standards. They are impact resistance so that flying debris does not penetrate them. Prescription glasses are permitted if side shields are installed. Safety glasses that fit over your prescription glasses are also available.

If any foreign debris should enter your eye, do not rub your eye. These particles can become lodged in your eye and cause severe damage. The best practice for removing debris from your eye is to pull the top eye lid over the bottom and flush with water. If irritation should persist, seek immediate medical attention.

2.2.2. EARS

Machining and manufacturing environments can be extremely loud at times. Hearing protection (see **Figure 6 and 7**) is recommended if sound levels are above 115 decibels for 15 minutes, or 90 decibels for 8 hours. Certain machining operations can cause loud constant noise. Depending on the level of noise, , **EARPLUGS** or **EARMUFFS** are recommended. Continuous noise at these levels can cause permanent hearing damage.

Explore: Don't let noise steal your hearing

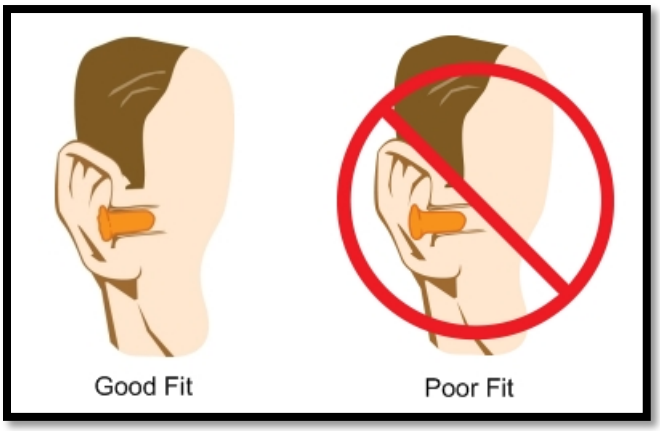


Figure 6: Proper use of earplugs (HearForever,Sperian Protection Group, 2013)

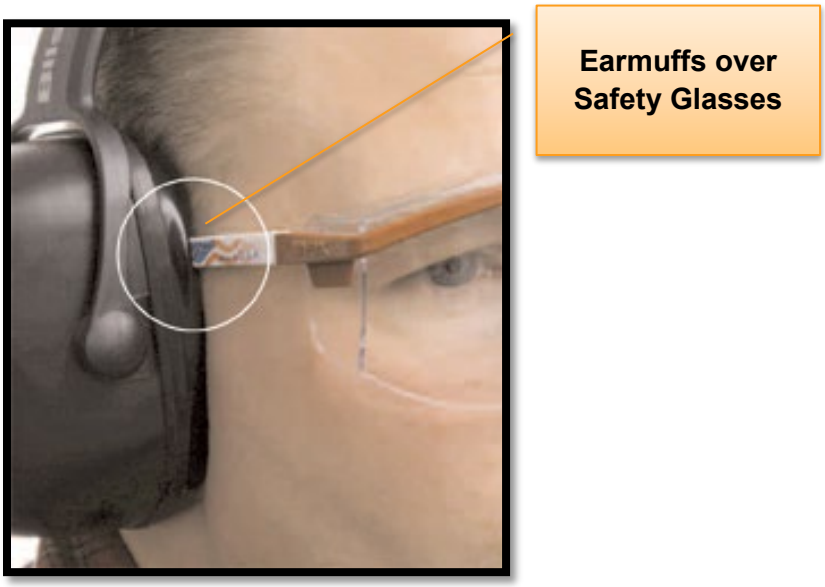


Figure 7: Proper use of earmuffs and safety glasses (HearForever, Howard Leight and Sperian Protection Group, LLC., 2013)

2.2.3. FEET

SAFETY SHOES, such as steel toe boots, should be worn in machining environments. They have hard slip/oil resistant flat soles. The hard flat sole can prevent metal chips

from penetrating it and causing injuries to the bottom of your feet. The floor in a machine shop can become slippery when cutting fluids are being applied to revolving equipment which can cause slipping hazards. Steel toes in the boots prevent falling objects from crushing toes. It may also be necessary for metatarsals to be used, which cover the tops of your feet. This depends on the manufacturing environment and company requirements.

2.2.4. LUNGS

RESPIRATORS are required when gases or particles are being released into the air from machining operations. Exhaust vents and hoods are used in most cases to cleanse the air. However, if they are not strong enough a personal respirator should be worn. There are two basic types of respirators: air-purifying and atmosphere supplying. Air-purifying have their own filters that remove gases and particles from the air so it is safe to breathe (see **Figure 8**). Atmosphere supplying respirators provide their own clean air to breathe.

Explore: Respirator – General Information

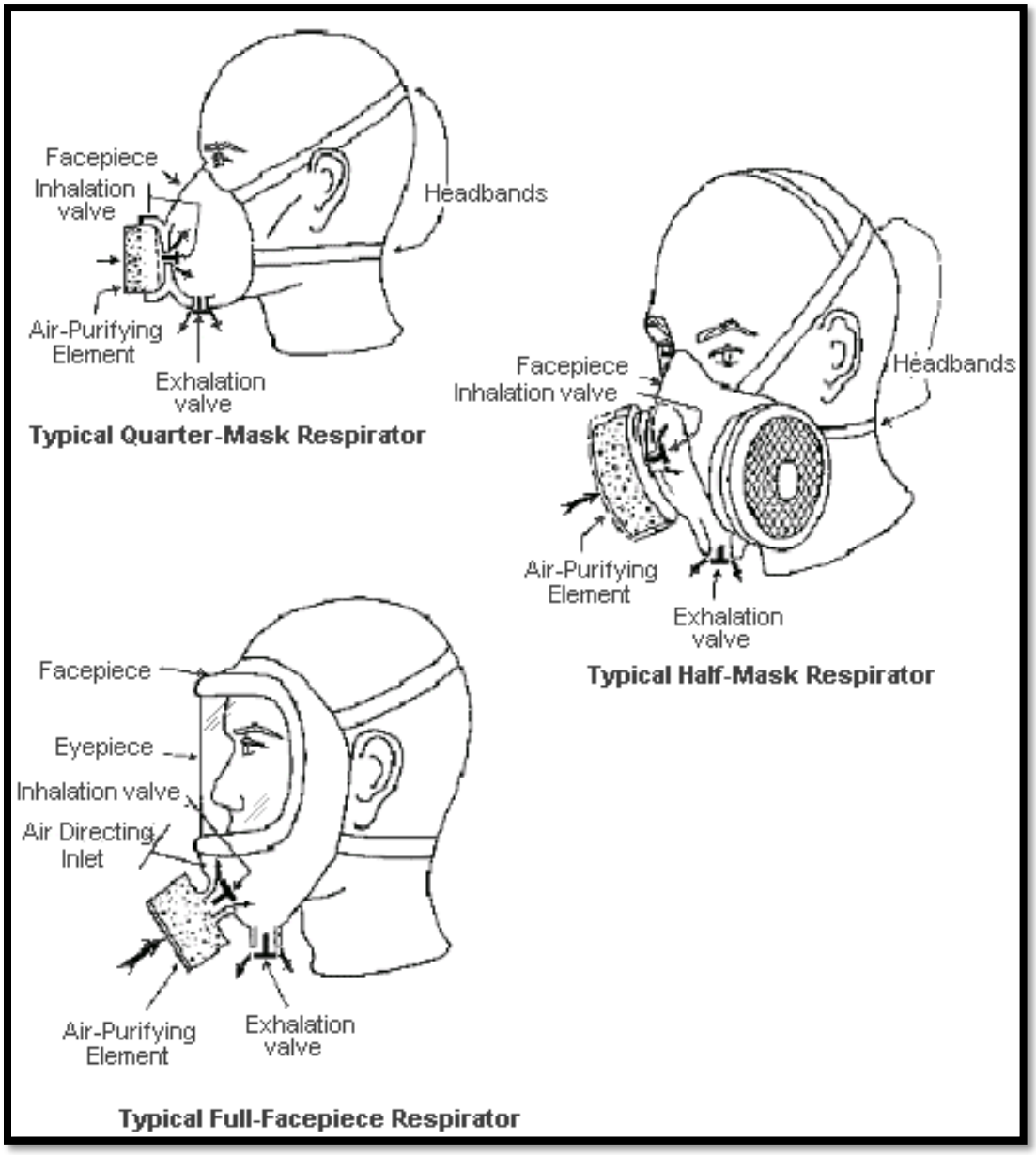


Figure 8: Respirator Protection (Department of Labor, OSHA, 2013)

ACTIVITY #2

Identify the importance of wearing protective equipment by completing the PPE Table below:

Parts of the Body	PPE	Hazard
Example: Hands	Example: Puncture Resistant Gloves	Example: Prevent from cutting self, abrasion from sharp instruments

2.3. HOUSEKEEPING

Housekeeping at home is simple. You keep things straightened up and clean because you live there. The same should apply to the work environment. In the work environment we keep things clean and organized for efficiency and safety.

2.3.1. ORGANIZATION

After a job is complete or at the end of the day, a good practice is to put away your tools and unused materials. Removing clutter on work benches and machinery is a good way to prevent injuries and hazards. Unused materials should be stored back in the material rack in their designated spots (see **Figure 9**). Tools should be cleaned and stored neatly so that they remain in good working condition. Never leave tools on top of machinery. This can result in damage to the tools and could cost the worker or the company.

Explore: Housekeeping in the Workplace

Figure 9: Illustration of an organized CNC tool cart with CAT40 Holders
(Image by Ladell Humphries, 2013)

2.3.2. SHOP CLEANING

Shop cleaning is as basic as cleaning your home. Sweep up shop floors or the floor in your work area and dispose of chips and debris in proper storage containers. Storing them in the proper containers is important because companies recycle material. Chips from different materials have to be stored separately. Spills should have an absorbent applied to soak up the excess liquid. Most shops and manufacturing facilities use granular absorbents. These absorbents must be disposed of properly. Shop rags should be stored in fire safety cans to avoid spontaneous combustion.

MAJOR CONCEPTS (HEADING 1)

KEY CONCEPTS

- General safety guidelines keep us safe in the workplace. OSHA and NIOSH regulate industry to ensure that basic safety guidelines are followed. These entities were put in place by the federal government.

- In a machining environment, certain protective equipment must be worn. PPE includes equipment that protects your eyes, ears, lungs, feet, and hands. Safety glasses are the most important piece of PPE in the machine shop. Metal chips can be ejected during machining operations. Gloves are not to be worn around revolving equipment.
- Fires consist of three components: oxygen, heat, and fuel. By removing any one of the three a fire can be extinguished. There are four classes of Classes A, B, C, and D. Each type of fire is classified by its fuel. The extinguishing media is determined by the class of fire. The appropriate extinguisher must be used.
- Housekeeping and organization skills dictate the longevity of delicate measuring instruments as well as hand tools. These components help to ensure safety in machining environments. Recycling companies that collect chips from material, created during machining operations, must be kept in separate containers.

KEY TERMS

OSHA
NIOSH
P.A.S.S.
lockout/tagout
MSDS
PPE

LABS

PHYSICAL LABS

MTT122 is a corequisite of MTT121

ASSESSMENT

MODULE REINFORCEMENT

True or False: Read the following questions and determine whether the statement is true or false.

1. Gloves must be worn to protect hands from hot metal chips.
2. Horseplay is not permissible under any circumstance.
3. NIOSH enforces all safety regulations set by the Federal Government.
4. Only two elements are needed to sustain a fire.
5. Water is an acceptable media used to extinguish a class C fire.
6. MSDS should be closely guarded from industrial workers.
7. Eye protection is the most common form of PPE.
8. Class B extinguishers are carbon dioxide based.
9. Loose fitting clothing is acceptable work attire in industry, as long as the worker is comfortable.
10. MSDS books should be updated routinely.
11. Lockout/Tagout is only used when a machine is operational.
12. Housekeeping includes cleaning all tools and neatly storing them.

Multiple Choice: Read the following questions or statements and select the best answer.

1. _____ is the federal agency that enforces safety in the workplace
    a. NIOSH
    b. OSHA
    c. ORCA
    d. NRA
    e. HMIS
2. _____ is an acronym used to describe the proper use of a fire extinguisher.
    a. P.A.S.S.
    b. P.U.L.L.
    c. P.U.S.H.
    d. P.U.M.P.
    e. P.U.N.T.
3. Which of the following articles of clothing are not acceptable under safety standards?
    a. Baggy jeans

b. Coveralls
c. Overalls
d. Short sleeved work shirt
e. Thermal undershirt

4. Which is the correct choice of PPE for a machining environment?
   a. Safety glasses with side shields
   b. Prescription glasses
   c. Face shield
   d. Lab goggles
   e. Sunglasses
5. _____is the correct form of footwear required in a shop.
   a. Sneakers
   b. Leather boots
   c. Flip flops
   d. Steel toe shoes or boots
6. Companies use _____ to inform workers of possible health hazards that they are exposed to.
   a. MSDS
   b. NIOSH
   c. OSHA
   d. NFPA
7. Class A fires consist of_____.
   a. Fuels, solvents, and flammable liquids
   b. Paper, cloth, wood, and plastic
   c. Electrical hazards
   d. Metals
   e. Chemicals
8. Which piece of information is not contained in MSDS?
   a. Health hazards
   b. Handling and use
   c. Physical/chemical composition
   d. Appropriate PPE required for use

Answer Key

True or False	Multiple Choice
1. F 2. T 3. F 4. F 5. F 6. F 7. T 8. T 9. F 10. T 11. F 12. T	1. B 2. A 3. A 4. A 5. D 6. A 7. B 8. D

ANSWER KEYS TO ACTIVITIES

ANSWER TO ACTIVITY #1

In two paragraphs or more, explain the Signs and Symptoms of over exposure to remover, cleaner, and thinner agents. Also, explain the proper procedure for administering First Aid care when exposed to harmful agents. Corrected - LM

ANSWER TO ACTIVITY #2

Fill in the table

Parts of the Body	PPE	Hazard
Example: Hands	Example: Puncture Resistant Gloves	Example: Prevent from cutting self, abrasion from sharp instruments
EYES	Safety Glasses	splash

EARS	Ear Plugs	Cancel noise
FEET	Steel Toe Shoes	Broken bones
LUNGS	Respirator	breathinig
Optional: Head	Hard Hat	Injury to the head
Optional: Face	Face Shield	debris

DISCUSSION PROMPTS

QUESTION 1

Why is safety an important component within industry?

QUESTION 2

Lockout/Tagout devices are required by OSHA. What are the dangers of removing Lockout/Tagout devices from equipment? Explain your answer.

CRITICAL THINKING

Job Description #2	Immediate Supervisor	Task	Result of Task
You are a Machinist…	…your immediate supervisor, Mr. Humphries…	…has asked you to list the dangers that could take place if a coworker isn't wearing appropriate PPE	…this will enable the student to learn what can happen when you are not paying attention.

Student Instructions:

1. List the proper PPE that should be worn in a shop.
2. List safety rules that apply to each piece of PPE.
3. Identify the dangers that are possible without having proper PPE.
4. Type an incident report, as if the accident has already happened.
5. Save your work and upload to the appropriate dropbox assignment.
6. SMILE 

…You have completed the task.

Grading Rubric for Instructors:

Two Tasks: Outside Micrometer and Caliper	Excellent (50 points max)	Good (45 points max)	Fair (40 points max)	Additional Practice Needed (35 points max)
1. List the proper PPE that should be worn in a shop.				
	Excellent (45 points max)	**Good (40 points max)**	**Fair (36 points max)**	**Additional Practice Needed (32 point max)**
2. List safety rules that apply to each piece of PPE.				
3. Identify the dangers that are possible without having proper PPE.				
	Turned In On Time (5 points)	**Turned in 1 day late (4 points)**	**Turned in 2 days late and gave reason to instructor on tardiness (3 points)**	**Turned in 3 days late or Did Not Turn In after day 2 tardiness (2 points)**
4. Type an incident report, as if the accident has already happened.				
Total				

ATTRIBUTION TABLE

Author/s	Title	Source	License
Wes Pelletier	Figure 1: Workplace Safety	http://www.slideshare.net/marshalllc/general-safety-trng-slides-24803701	Creative Commons Attribution 3.0 Unported License.
Terry Weston	Figure 2: Fire Extinguisher PASS system	http://youtu.be/aU35ioqiJmA	Public Domain
Port Ludlow Fire & Rescue www.plfr.org	Figure 3: P.A.S.S. Fire Extinguisher Acronym	http://plfr.org/public-education/fire-safety/fire-extinguishers-A-using.php	Port Ludlow Fire & Rescue www.plfr.org – permission to share information on website. See Terms of Use: http://plfr.org/copyright.php
www.elcosh.org	Figure 4: Reading Material Safety Data Sheet (MSDS)	http://www.elcosh.org/document/51/d000756/BUILT%253A%2BToxics%2B%2526%2BTobacco%2Bon%2Bthe%2BJob%2B-%2BProtecting%2BYour%2BHealth%253A%2BConstruction%2BWorkers%2527%2BGuide.html?show_text=1	www.wlcosh.org – permission to share information on website. See Disclaimer: http://www.elcosh.org/en/disclaimer.php
PM Production Machining - Gardner	Figure 5:	http://www.productionmachining.com/article	ProductionMachining.com –

Business Media	Personal Protective Equipment	s/personal-protective-equipment-and-the-precision-machining-industry	permission to link to website. See Disclaimer: http://www.productionmachining.com/disclaimer
Brad Wit – Howard Leight / Sperian Protection Group, LLC	Figure 6: Proper use of earplugs	http://www.hearforever.org/quiz/fact-or-fiction-hearing-protectors	Sperian Protection Group – Allow to display from website. See Terms of Use: http://www.hearforever.org/terms-of-use
Brad Wit – Howard Leight / Sperian Protection Group, LLC	Figure 7: Proper use of earmuffs and safety glasses	http://www.hearforever.org/tools-to-learn/sound-source-earmuffs-safety-eyewear	Sperian Protection Group – Allow to display from website. See Terms of Use: http://www.hearforever.org/terms-of-use
Department of Labor / OSHA.gov	Figure 8: Respirator Protection	https://www.osha.gov/dts/osta/otm/otm_viii/otm_viii_2.html#1	Public Domain

Ladell Humphries	Figure 9: Illustration of an organized CNC tool cart with CAT40 Holders	Author	Creative Commons Attribution 3.0 Unported License.

This workforce solution was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The solution was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites, and including, but not limited to accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability or ownership.