

Learning Activity Packet

# General Safety, Lean Production and Problem Solving



career tech

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# General Safety, Lean Production and Problem Solving

### PURPOSE

In this learning activity packet, you will become familiar with the factors that affect safety in the workplace, identify common items of personal protective equipment, recognize ways to improve fire safety, explain how safety relates to specific categories of hazard, apply the safety color code, state rules for using tools safely, learn a basic process for solving problems, define lean production principles, and learn basic terminology.

### OBJECTIVES

1. Describe factors in creating a safe workplace.
2. Identify common items of personal protective equipment (PPE).
3. Explain fire safety.
4. Compare hazard categories.
5. Explain the safety color code.
6. State safety rules for using hand tools and power tools.
7. List the steps in an eight-step problem solving process.
8. State the basic principles of lean production.

### KEY TERMS

**downtime**—time a machine or operator is not producing parts, due to machine malfunction, tooling and/or cutter changes, waiting for material, operator absence, etc.

**productivity**—a measure of performance in a given period, including time not spent producing parts (downtime), stated as a percentage of total time

**Note:** Time spent in activities other than making parts takes away from an operator or machine productivity. Equipment downtime due to maintenance or malfunction, waiting for materials, and/or company activities or meetings all take away from productivity. Whenever an individual or machine is not producing a product (downtime), productivity levels are reduced. The operator must understand productivity calculations to improve planning and performance.

## PERSONAL LEARNING PLAN

- 1. Read the Purpose and Objectives.
- 2. Review the Key Terms.
- 3. Study Information Sheet 1-1.
- 4. Study Information Sheet 1-2.
- 5. Study Information Sheet 1-3.
- 6. Study Information Sheet 1-4.
- 7. Study Information Sheet 1-5.
- 8. Study Information Sheet 1-6.
- 9. Study Information Sheet 1-7.
- 10. Study Information Sheet 1-8.
- 11. Take the Quiz (if your instructor provides one).

## Creating a Safe Workplace

An **accident** is an undesirable event that often results in harm or injury to individuals, property or the environment. Accidents often occur due to an unsafe condition or behavior, and many accidents can be prevented. One careless incident or inattention to detail could lead to a lifetime of disability. Injuries from accidents such as falls, slips, trips, falling objects, fires, exposure to heat and cold, and contact with chemicals, hazardous materials and machinery can be minimized by creating a safe workplace.

A primary factor in creating a safe workplace is good housekeeping. Accidents such as trips, slips, falls, and objects toppling on individuals often occur because of poor housekeeping. Organizing the shop creates a safer workplace as well as a more positive work environment. Organizing the shop can include using color-coded signs to indicate hazards and specific areas. Items such as fire extinguishers and first-aid kits should be easily accessible and located in designated areas.

Work areas should be set up to allow ample room for the work being done. One important aspect of good housekeeping and organization is having the proper storage for materials and tools. Materials and tools left out, especially in walkways, are trip hazards. The aisle ways and walkways of the shop as well as all exit paths should always be kept clear. In addition, items stored improperly may be prone to falling. Proper storage should also be provided for chemicals, fuels and waste materials.

Part of good housekeeping is keeping work areas clean. After working, you should always clean dirt, debris or grease from the area and properly put away any tools and materials used. There are many types of tools and machines in a shop. It is important that all machinery be installed, used and maintained following the manufacturer's recommendations.

Notes:

A safe workplace environment is one that follows all applicable building and electrical codes. The National Electrical Code® is the standard for the safe installation of electrical wiring and appliances in the United States. The National Electrical Code® is one of the standards published by the National Fire Protection Association® (NFPA®). Local communities adopt standards, such as fire and life safety codes, that must be followed.

To create a safe work environment, you must take a “safety first” attitude and work cooperatively. Human attitude and behavior are a significant factor in workplace safety. Always wearing the appropriate personal protective clothing and gear, being aware of what is happening in the workplace, following shop rules, and taking care of the workplace are important safety factors in any workplace.

Notes:

## Personal Protective Equipment

Protective clothing and personal protective equipment (PPE) are mandatory in the shop to reduce exposure to hazards. Protective clothing and PPE protect areas of the body where injury might occur while working.

The eyes and face are particularly vulnerable to injuries. Eye injuries can occur from chemical spills, flying objects such as wood or metal chips, or fumes from gases or chemicals. Appropriate safety glasses or goggles should always be worn. Eye and face protection should meet American National Standards Institute (ANSI) standards. The type of eye and face protection worn should match the work being done. Shop hazards such as flying metal, arc rays, and welding fumes can cause serious injury to the face and eyes.

All safety glasses, goggles, face shields or helmets should properly fit the user. Safety glasses with side shields provide protection for general shop work and protect against dust and flying objects. Safety glasses should always be worn as *minimum protection* in the shop.

**Safety goggles** are available in clear or tinted models and may also have port-vented or non-vented frames. Safety goggles provide protection from splashes, and when working around chemicals, a person should wear safety goggles without vents. Tinted goggles provide protection from harmful rays or bright lights. Cup goggles provide a tight fit around the eyes and may be used for certain tasks in the shop. Safety **face shields** protect both the eyes and face against flying objects, metal sparks or liquid splashes. Face shields provide good visibility when chipping or grinding and protect from slag or metal.



Your instructor will show you samples of safety goggles and face shields.

Notes:

**Welding helmets** provide protection to the eyes and face from hazards when welding, such as ultraviolet and infrared light, burns, sparks, metal chips and heat. Many different types of welding helmets are available. Variables in welding helmets include standard versus auto-darkening lens, fixed or variable shade lens, and different battery and solar assist panels. The welding helmet must have the correct lens shade for the work being performed. Welding caps are worn under welding helmets to help protect the scalp and ears.



Your instructor will show you samples of welding helmets.

A **hard hat** is worn in situations where the danger of falling materials or tools may be present. Hard hats are typically lightweight and provide impact protection to the head.

**It is important in the shop that long hair be contained so it does not become tangled in tools or equipment. Long hair should be secured back so it does not present a risk. In addition, jewelry should not be worn in the shop as it may catch on tools or equipment, creating a hazard. Jewelry can also conduct electricity, presenting a burn or electrical shock hazard.**

**Clothes** worn in the shop should fit properly and should not have parts that may catch in machinery, such as ties or strings. Non-insulated coveralls are all-purpose clothing that can be worn in the shop. Insulated coveralls are synthetic, which could prevent a person from feeling heat from a fire, and should not be worn. Coveralls should have pocket flaps to keep materials from falling into pockets and should not have cuffs. A heavy, long-sleeved shirt with pocket flaps and heavy pants with no cuffs or fraying at the bottom may also be worn.

Clothing worn in the shop must not be made of synthetic materials such as polyester or rayon. Cotton is the most common clothing fabric used.

Notes:



Heavy leather boots with uppers that reach above the ankle can be worn to prevent burns from sparks and splatter. Steel-toed boots are not required but are highly recommended as the best choice.

Aprons and shop coats made of materials such as leather, vinyl or rubber can be worn to provide additional protection to the front of the body and upper legs. Vinyl or rubber aprons can be used when liquid splashes are a hazard. Shop coats are easy to use and provide protection for the arms, body and upper legs.

Heavy leather gloves with gauntlets, or protective coverings for the forearms, are used for welding and cutting activities. Rubber or vinyl gloves must be used for work with liquids or chemicals. **Ear protection**, including earmuffs and ear plugs, is worn to protect against noise levels. Continued exposure to loud noises can result in hearing loss.



Your instructor will show you samples of clothing and ear protection.

**Respiratory protection**, such as masks and respirators, is used to protect against toxic fumes and gases. Simple face masks can be used to filter out dust while a respirator is required to protect against toxic fumes or gases.

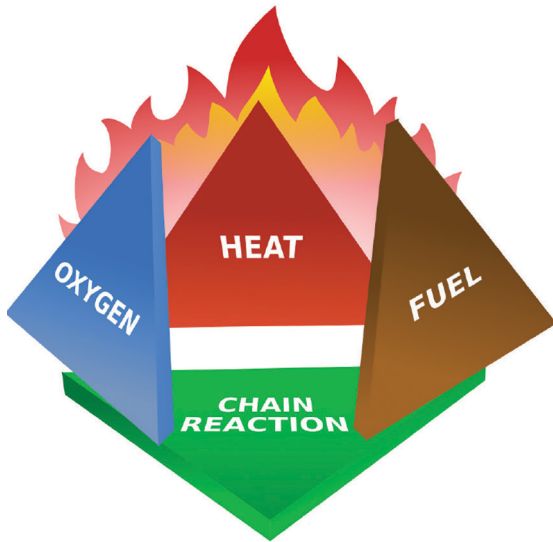
Notes:

Notes:

# Fire Safety

A shop is at fire risk from welding torches, electrical circuits and flammable substances. Additionally, items like oily rags, lumber scraps and sawdust are fuel to a fire. It is important to know how to decrease the risk of fire and how to respond in case of a fire. Always be aware of the location of fire extinguishers in the shop and know how to properly use them.

The **fire tetrahedron** consists of fuel, oxygen, heat, and an uninhibited chemical chain reaction. Including the uninhibited chemical chain reaction more fully explains what must be present for a fire to occur. All of these components are necessary in order to sustain a fire. The uninhibited chemical chain reaction is the process that generates and sustains the fire, allowing it to continue burning.



Wikipedia Commons Image

Notes:

Fires are classified into categories according to the fuel source. These categories determine the type of extinguisher to use on the fire. Portable fire extinguishers are identified either by a letter, symbol, or graphic illustration.

Multipurpose fire extinguishers can be used on two or more different types of fires and will contain the letters or symbols of the fire types they will extinguish. Examples of multipurpose fire extinguishers are A-B-C, A-B, and B-C. Fire extinguishers may also use graphic illustrations showing the fires the extinguisher should NOT be used on with a line through the graphic.

**Class A** — Fires that occur in ordinary combustibles such as wood, cloth, paper, rubber and many plastics.

**Class B** — Fires that occur in flammable and combustible liquids. Examples include petroleum greases, tars, oil, solvents, lacquers, alcohols and flammable gases. Class B fires are extremely hazardous and water alone may not be an effective extinguishing agent.











**Class C** — Fires that involve energized electrical equipment. Without the energized electrical equipment, these would be Class A or B fires. Because water is a good conductor of electricity, the use of water on these fires creates safety hazards and is dangerous.

**Class D** — Fires that involve combustible metals such as magnesium, titanium, zirconium, sodium, lithium and potassium.

**Class K** — Fires that involve vegetable oils, animal oils, or fats in cooking appliances. Class K extinguishers are often found in commercial kitchens.

Notes:

## Fire Extinguisher Classes and Symbols

	Class A extinguishers put out fires in ordinary combustible materials such as cloth, wood, rubber, paper, and many plastics.	 Ordinary Combustibles
	Class B extinguishers are used on fires involving flammable liquids, such as grease, gasoline, oil, and oil-based paints.	 Flammable Liquids
	Class C extinguishers are suitable for use on fires involving appliances, tools, or other equipment that is electrically energized or plugged in.	 Electrical Equipment
	Class D extinguishers are designed for use on flammable metals and are often specific for the type of metal in question. These are typically found only in factories working with these metals.	 Combustible Metals
	Class K fire extinguishers are intended for use on fires that involve vegetable oils, animal oils, or fats in cooking appliances. These extinguishers are generally found in commercial kitchens, such as those found in restaurants, cafeterias, and caterers. Class K extinguishers are now finding their way into the residential market for use in kitchens.	 Combustible Cooking

Notes:

### Life safety is the first priority when involved in a fire.

You must be properly trained on the use of portable fire extinguishers and understand when they can be effectively used. Upon initial discovery of a fire, everyone in the shop should be alerted with someone instructed to call the fire department—do not wait for the fire to escalate before calling. A fire extinguisher may be used when the fire is small and confined to the initial fuel source, such as a fire in a wastebasket. Before using a fire extinguisher, a person should ensure that he or she is safe from toxic smoke and that there is an escape route. If there is any question as to whether it is safe or not, do not attempt to extinguish the fire.



**CAUTION:** Portable fire extinguishers are meant for small fires in a confined area. In addition, fires can increase in size in a very short amount of time.

Fire extinguishers must be in good working condition and in the proper locations in the shop. If a fire extinguisher appears damaged in any way, do not use it. The **PASS** application method is a way to remember how to effectively use a portable fire extinguisher:

**P** — Pull the pin.

**A** — Aim at the base of the fire.

**S** — Squeeze the trigger.

**S** — Sweep side to side.



Your instructor will demonstrate how to use a portable fire extinguisher.

Notes:

## Hazard Categories

It is important to maintain a safe work environment by keeping risks at a minimum. This is done by eliminating hazards when possible. A **hazard** is a risk or danger of harm to life, health, property or the environment. Since not all risks can be eliminated, hazards that affect a safe environment must be managed through education, maintaining tools and equipment, following defined management practices, applying color coding where appropriate, and using suitable personal protective equipment (PPE). Shop hazards typically fall into one of six categories: human, electrical, mechanical, environmental, chemical or fire.

**Human hazards.** Human error and inattention is a factor in many workplace accidents. You must be aware of the hazards and know the steps for maintaining a safe work environment. You must receive safety training and know how to properly use machinery and equipment. A safe attitude and behavior is important at all times. The shop is not a place for horseplay.

You should never work when you are fatigued (tired) – fatigue can cause impaired judgment, slower reactions and a lack of attention to detail. You should also never work when your ability to function, either mentally or physically, is compromised. For example, some medications may make you drowsy.

Anyone working in the shop should understand and follow proper procedures. For example, properly lifting objects can help prevent injuries. Lifting injuries are commonplace and result from either lifting too heavy of an object or lifting improperly. Placing undue strain on the body can also cause injuries.

Notes:

**Electrical hazards.** Electrical hazards are common in a shop and can cause burns, shock and electrocution. Electrical equipment can also serve as an ignition source, resulting in fires. Electrical hazards can be minimized by following safety guidelines and properly maintaining electrical tools and equipment.



Your instructor will point out examples of electrical hazards.

**Mechanical hazards.** Mechanical hazards come from the operation of hand and power tools and machinery. Hazards can result in numerous injuries such as burns, cuts, crushed hands or arms, severed fingers, eye injuries and entanglement. There are various mechanical motions and actions that are hazardous such as rotating blades, wheels, belts, gears and reciprocating arms. Mechanical hazards occur in three areas: point of operation, point of power transmission and other moving parts:

Point of operation—the location where work is taking place on the material, such as cutting or shaping.

Point of power transmission—occurs where components of the mechanical system transmit energy to the machine performing work; the point of power transmission includes components such as flywheels, pulleys and belts

Other moving parts—parts of the machine that move and create mechanical hazards; moving parts may include reciprocating and rotating moving parts and feed mechanisms

Mechanical hazards can be reduced several ways. The manufacturer’s recommendations should always be followed for the use and care of tools and machinery.



**CAUTION: Operators must always be properly trained in using equipment. An individual should never operate a tool or machine which he or she is not trained to use.**

Notes:



Notes:

A primary method for reducing the risk of mechanical hazards is to use the appropriate guards on all tools and machines. A **guard** is a protective device on tools and machines to protect the user from injury and should never be removed. Another way to reduce the risk of mechanical hazards is to always wear the appropriate PPE for the task. When using machinery, you must always be aware of where your body is in relation to the machine parts.



Your instructor will point out examples of mechanical hazards, as well as guards on tools and machines.

**Environmental hazards.** Environmental hazards include those that arise from the physical setup of the workplace and from weather conditions. Slips, trips and falls are common workplace accidents. Flooring materials can be slippery, especially after being cleaned or waxed. Trips can occur when items are left in passageways or when extension cords are in walkways. In addition, objects that are not properly secured or stowed may fall on top of workers. Weather conditions also present hazards to individuals. Working in extreme cold can cause injuries such as frostbite. Working in extreme heat can lead to heat-induced injuries such as heat exhaustion or even heat stroke. It is not advisable to work in extreme heat or cold.



Your instructor will point out examples of environmental hazards.

**Chemical hazards.** Chemical hazards are present in many workplaces because of toxic chemicals used. These hazards can cause injuries to the body parts they come into contact with such as the skin and mucous membranes of the eyes, nose and mouth. Some chemicals will burn human tissue when contact occurs. Toxic chemicals can also affect the respiratory tract when inhaled. In addition, some chemicals are known to be carcinogenic, meaning they are cancer-causing agents.

Toxins can have an acute *effect* in which symptoms appear soon after exposure. Other toxins may have a *chronic effect* in which symptoms surface much later, perhaps even years after exposure. An example of a chronic effect of chemical hazards is cancer.

Precautions should always be taken to minimize chemical hazards. The correct PPE for the task should always be worn, and manufacturer recommendations for use should always be followed. Chemicals should be stored in original containers in an appropriate location, such as a locked cabinet. Never mix unknown chemicals; some chemicals may react violently when mixed inappropriately. For example, mixing bleach with ammonia produces toxic vapors.

**Fire hazards.** Fire hazards present a significant risk in the shop and can cause human injuries, such as burns, as well as damage or destruction to property. Actions such as welding and using electrical machinery can provide ignition for fuels. In addition, shops often have flammable materials that present fire hazards. To minimize fire hazards, flammable materials should be stored correctly. Before welding or using equipment that may present a fire hazard, check for and remove items that provide fuel for fires. Good housekeeping, such as properly disposing of oily rags, also helps minimize fire hazards. The appropriate fire extinguishers should be available and current, and you should be trained to use a fire extinguisher in the event of a fire.



Your instructor will point out examples of fire hazards.

Notes:

# Safety Color Code

Creating a safe work environment is essential to avoiding accidents and injuries. When people know and understand color codes, safety is increased. You should become familiar with the colors and signs used in the workplace. Color coding helps you identify specific hazards or dangers. It also helps you locate objects and organize the work area. Various organizations and agencies such as OSHA and ANSI have set standards on color coding. While there are variations in color coding systems, the colors have become standardized in many areas, providing consistency for workers.

**RED** — used to identify fire protection equipment and apparatus, and to designate “danger” or “stop.” Red is used to identify portable containers of flammable liquids. The color is also used to show emergency shut-off switches, stop bars, and stop buttons. Safety signs indicating danger should be painted red.

**YELLOW** — used to designate caution and mark physical hazards such as stumbling, falling, tripping, striking against, and caught-between. Colors used for designation may be solid yellow, yellow and black stripes, or checkers.

**ORANGE** — used to designate dangerous parts of machinery and parts of equipment that can cause electric shock. This color identifies parts of machinery or equipment that can cause injuries by cutting, crushing, shocking or other means. Orange is used to identify hazards such as exposed edges and openings of pulleys, gears, rollers, cutting devices, and power jaws.

**GREEN** — used to designate safety and first-aid equipment. Green is used to identify areas where medical treatment may be given, such as safety showers.

**BLUE** — used to warn against starting equipment, moving equipment, or using equipment under repair.

Notes:

**PURPLE** or **BLACK AND YELLOW** — used to designate radiation hazards.

**BLACK AND WHITE** — used to designate traffic movement and housekeeping areas.



Your instructor will point out examples of the safety color code.

Notes:

# Hand Tool and Power Tool Safety

Notes:

## Using Hammers

Hammers are driving tools. Driving tools are used to force other objects to move.

- Use the right kind of personal protective equipment.
- Use the right hammer for the job.
- Wear safety goggles when using a hammer with a striking tool, such as a chisel or stake.
- Never strike a mushroomed tool.



**CAUTION:** Splinters could strike you in your eyes.

- Do not strike two hammer faces together.
- Hold the hammer near the end of the handle.

**NOTE:** This will increase your accuracy and decrease your chances of hitting your fingers.

- Check for a tight handle before using a hammer.
- Strike hammer blows squarely with the face of the hammer.

## Using Screwdrivers

Screwdrivers are turning tools. Turning tools are used to turn fasteners such as screws, nuts, and bolts.

- Use the right kind of personal protective equipment.
- Use the right screwdriver for the job.
- Use the right size blade or bit for the screw.

**NOTE:** The wrong size blade or bit can cause the screwdriver to slip.

- Do not use a screwdriver to pry objects.

- Do not hold onto the screw while using a screwdriver.



**CAUTION:** The screwdriver could slip and cut your hand.

- Keep the tip of a screwdriver away from power outlets and other sources of electrical current.
- Clean screwdriver handles after every use.

### Using Wrenches

Wrenches are turning tools. Turning tools are used to turn fasteners such as screws, nuts, and bolts.

- Use the right wrench for the job:
  - Crescent/adjustable wrench—use to apply force in one direction
  - Open-end wrench—use where you have room for movement
  - Box-end wrench—use where you have limited room for movement
  - Combination wrench—use when you need an open-end or box-end wrench
  - Pipe wrench—use to work with pipes and rods
  - Socket wrench—use when the fastener is recessed or hard to reach
- Make sure the wrench fits tightly on the nut or bolt.

**NOTE:** Make sure the wrench fits the fastener.

- Do not use an “extender” on the handle of any wrench.



**CAUTION:** You could injure yourself, damage equipment, or break the wrench if the extender slips.

- With crescent/adjustable wrenches, apply force on the fixed jaw—not on the adjustable (weaker) jaw.

Notes:

## Using Pliers

- Pliers are holding tools. Holding tools are used to grip and securely hold materials or objects.
- Use the right kind of pliers for the job.

Example: You could damage long-nose (needle-nose) pliers by using them to bend thick wire.

- Use the right kind of personal protective equipment.
- Do not use pliers to hammer an object.

## Using Files

- Use the right kind of file for the job.

**NOTE:** The right file can help prevent injuries, increase the life of the file, and make the job easier.

- Do not use a file that does not have a secure handle.



**CAUTION:** The exposed tang could pierce your hand and cause a serious injury.

- Clean files with a file-cleaning card only—not by striking the file against another object.

**NOTE:** Files can chip easily.

- Do not hammer or pry an object using a file.

**NOTE:** Files can chip and break easily. Use a file for filing, not for hammering, prying, punching, chiseling, or other uses.

- Clamp the work to be filed in a vise at about waist-height.

**NOTE:** To file, you must apply pressure. The pressure could cause the object to move or to slip.

Notes:

- Hold the file handle securely in one hand and guide the point of the file using the thumb and index finger of the other hand.

**NOTE:** This technique will help you to control the file and to complete the job safely.

- Push the file forward as you press down on it, then release your pressure on the file on the return stroke.

**NOTE:** If you do not release your pressure on the return stroke, you will wear out the file teeth quickly.

### Using Power Tools

- Wear the right clothing for the job.



**CAUTION:** Loose clothing or jewelry can become caught in moving parts.

- Never carry a power tool by its cord.
- Never use a damaged power tool.
- To disconnect a power tool, tug on the plug, not on the cord.
- Keep cords away from heat, oil, and sharp edges.
- Disconnect power tools: when you are not using them, before servicing and cleaning them, and when changing accessories such as blades, bits, and cutters.
- Secure the work with clamps or a vice, as appropriate.
- Avoid accidental starting—keep your fingers off the starting switch/button while carrying a tool that is plugged in.
- Keep power tools clean and sharp for top performance.
- Follow the user's manual for instructions about maintenance and accessories.
- Maintain a good footing and balance while operating any power tool.

Notes:



## 8-Step Problem Solving Process

Many workplaces in manufacturing and maintenance use a standard process for solving problems that relate to production or other issues. One such process has eight steps. These steps appear below, with the questions to be answered for each step.

Notes:

### 8-Step Problem Solving Process

<p><b>Step 1—Clarify and validate the problem.</b></p> <ul style="list-style-type: none"> <li>• What is the problem?</li> <li>• Where did the problem occur?</li> <li>• When did the problem occur?</li> <li>• What is the significance of the problem?</li> </ul>	<p><b>Step 2—Break down the problem and identify performance gaps.</b></p> <ul style="list-style-type: none"> <li>• Do we have enough information, or is more analysis needed?</li> <li>• What is the gap between the current performance and the customer’s requirements?</li> <li>• Does the data point to any specific root causes?</li> <li>• Does the data indicate a bottleneck or constraint?</li> </ul>
<p><b>Step 3—Set B-SMART improvement targets.</b></p> <ul style="list-style-type: none"> <li>• Balanced?</li> <li>• Specific?</li> <li>• Measureable?</li> <li>• Attainable?</li> <li>• Results-focused?</li> <li>• Timely?</li> </ul>	<p><b>Step 4—Determine root causes.</b></p> <ul style="list-style-type: none"> <li>• Which root cause analysis tool is appropriate?</li> <li>• What root cause(s) do the tools suggest?</li> <li>• Will tackling the root cause(s) improve the performance gap?</li> <li>• Will tackling the root cause(s) eliminate the problem?</li> </ul>

<p><b>Step 5—Develop countermeasures.</b></p> <ul style="list-style-type: none"> <li>• Common reports and templates for sharing information?</li> <li>• Most practical and effective?</li> <li>• Clear and detailed action plan?</li> <li>• Involvement by stakeholders?</li> </ul>	<p><b>Step 6—See the countermeasures through.</b></p> <ul style="list-style-type: none"> <li>• Reduce waste?</li> <li>• Eliminate bottlenecks?</li> <li>• Reduce variation and errors?</li> <li>• Overhaul how work is done?</li> </ul>
<p><b>Step 7—Confirm results and process.</b></p> <ul style="list-style-type: none"> <li>• Results relative to the performance gaps in step 2?</li> <li>• Performance relative to the B-SMART targets?</li> <li>• Correct root cause(s) identified?</li> </ul>	<p><b>Step 8—Standardize successful processes.</b></p> <ul style="list-style-type: none"> <li>• How can improvements be standardized?</li> <li>• How should lessons be communicated?</li> <li>• Were new opportunities or problems identified?</li> </ul>

Notes:

# Basic Principles of Lean Production

Manufacturers, corporations, and the military use specific management techniques to monitor production and the steps in processes to ensure efficiency. The goal is to determine if people, time, and materials are contributing to production in the most efficient way. A common management technique is lean manufacturing or lean production—often simply called “lean.” The purpose of lean principles is to identify and eliminate waste within a production process. By eliminating waste—and anything else that adds no value to a product or service—lean principles result in a product or service of greatest value to the customer.

## 8 Types of Waste

**D** = Defects (errors that cause rework, reclassification, or scrap)

**O** = Overproduction (producing a higher quantity than what’s needed)

**W** = Waiting (people, parts, and equipment not being fully employed)

**N** = Non-standard and Over-processing (doing more than what’s needed on a unit)

**T** = Transportation (moving people, parts, and equipment unnecessary distances)

**I** = Injuries (people getting hurt, equipment and parts damage)

**M** = Motion (excessive movement within a work cell)

**E** = Excess Inventory (having more parts/supplies than what can be obtained or consumed within a reasonable time)

What You Can Do:

**IDENTIFY it.**

**PREVENT it.**

**REDUCE it.**

**ELIMINATE it.**

Notes:

Notes: