Mineral Resources Infrastructure Work

Level I

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LG #50	LO #1- Plan and prepare

Instruction Sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Organizational policies and procedures in planning and preparation
- Environmental protection requirements
- Accessing, interpreting and applying relevant compliance documentation
- Obtaining, confirming and applying work instructions
- Obtaining, confirming and applying the site safety plan and Safety requirements
- Selecting Plant, tools and equipment
- Characterization of basic soil types
- Identifying, confirming and applying project environmental management plan
- Materials Safety Data Sheets (MSDS)and materials handling methods
- Job Safety Analysis (JSA)

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Organizational policies and procedures in planning and preparation
- Environmental protection requirements
- Access, interpret and apply relevant compliance documentation
- Obtain, confirmi and applyi work instructions
- Obtain, confirmi and apply the site safety plan and Safety requirements
- Select Plant, tools and equipment
- Characterization of basic soil types
- Identify, confirming and applying project environmental management plan
- Materials Safety Data Sheets (MSDS)and materials handling methods
- Job Safety Analysis (JSA

Learning Instructions:

Read the specific objectives of this Learning Guide.

1) Follow the instructions described below 3 to 6.
2) Read the information written in the information “Sheet 1, Sheet 2, Sheet 3, and Sheet 4” and sheet 5.
3) Accomplish the “Self-check 1, and Self-check 2” in page 9, and 10respectively.
4) If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, and Operation Sheet 2” in page 11 and 12 respectively.
5) Do the “LAP test” in page – 13 (if you are ready).

Information Sheet 1- Organizational policies and procedures in planning and preparation

1.1 Concept of organizational policies and procedures

Organizational policies and procedures establish the rules of conduct within an organization, outlining the responsibilities of both employees and employers. Organizational policies and procedures are in place to protect the rights of workers as well as the business interests of employers. Depending on the needs of the organization, various policies and procedures establish rules regarding employee conduct, attendance, dress code, privacy and other areas related to the terms and conditions of employment.

Employee Conduct Policies

An employee code of conduct is a legal document that provides guidelines on acceptable behaviors of individuals in an organization. The employee code of conduct defines acceptable behavior and social norms that individuals in an organization should adopt on a day-to-day basis.

An employee conduct policy establishes the duties and responsibilities each employee must adhere to as a condition of employment. Conduct policies are in place as a guideline for appropriate employee behavior, and they outline things such as

- ✓ proper dress code
- ✓ workplace safety procedures
- ✓ harassment policies and

policies regarding computer and Internet usage. Such policies also outline the procedures employers may utilize to discipline inappropriate behavior, including warnings or employee termination.

Companies are increasingly paying attention to bullying behavior as a serious issue and beginning to adopt policies in this area as well.

Equal Opportunity Policies

Equal opportunity laws are rules that promote fair treatment in the workplace. Most organizations implement equal opportunity policies – anti-discrimination and affirmative action policies, for example – to encourage unprejudiced behavior within the workplace.

Attendance and Time off Policies

Attendance policies set rules and guidelines surrounding employee adherence to work schedules. Attendance policies define how employees may schedule time off or notify superiors of an absence or late arrival. This policy also sets forth the consequences for failing to adhere to a schedule. For example,

employers may allow only a certain number of absences within a specified time frame. The attendance policy discusses the disciplinary action employees face if they miss more days than the company allows.

Workplace Security Policies

Policies on security are in place to protect not only the people in an organization, but the physical and intellectual property as well. Policies may cover entrance to a facility, such as the use of ID cards and the procedures for signing in a guest. Equipment such as a company laptop or smartphone may need to be signed out.

1.2. Planning and preparing work

Planning is the process by which the managers of an organisation set objectives, make an overall assessment of the future, and chart the courses of action with a view to achieving the organisational goals.

Planning and organizing work is a necessary part of an efficient and safe workplace. When work is planned, it will have a better chance of running smoothly. You will regularly receive instructions on the jobs you need to perform.

- The main elements of planning and organizing a work include:

✓ The tasks;
✓ Who is involved?
✓ The resources you will need to complete them;
✓ Time (how long each task should take); and,

Other information such as safety and advice for task completion.

Planning will assist you to achieve required outcomes and avoid work downtime. Planning and organizing work is the key to ensuring a safe, efficient and effective work output. If you are disorganized, chances are you will feel overwhelmed by your work.

Time management is fundamental to organization.

It involves:

✓ Looking at the task to be completed;
✓ Working out the time it will take;
✓ Deciding on the type of equipment and materials to use;
✓ Delegating parts of tasks / services to others; and,
✓ Allowing for any possible problems or risks that might occur

Clear purpose

In any work you must have a clear idea of what you are setting out to achieve.

Get your priorities clear in your mind and if necessary write them down so you can carry them out easily. When being told what to do, just remember it is..

Setting Priorities

One of the first things you must do when given a work instruction is to be clear about what is required as the outcome. Once you know what you are expected to achieve you can work backwards and plan how to get it done!

As you look 'backwards' at the job, you need to think about what stages or small tasks (often called sub-tasks) need to occur to get the job done.

Self-Check -1	Written Test

Directions: Answer the following question

1. what is Organizational policies and procedures? (5)

2. List out the main elements of planning and organizing for a job. (5 points)

3. Briefly explain the advantage of Setting Priorities for a given work. (3points)

4.Explain the employee conduct policies(5)

Note: **Satisfactory rating – 18 points** **Unsatisfactory - below 17 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet 2- Environmental protection requirements

2.1. Environmental protection

Environmental protection is the practice of protecting the natural environment by individuals, organizations and governments.

Its objectives are to conserve natural resources and the existing natural environment and, where possible, to repair damage and reverse trends.

It refers to any activity to maintain or restore the quality of environmental media through preventing the emission of pollutants or reducing the presence of polluting substances in environmental media. It may consist of:

(a) changes in characteristics of goods and services,

(c) changes in production techniques,

(e) recycling,

2.2 Environmental Law

Humanity has been aware of its environment far longer than there have been laws to protect environments. Environmental law, or sometimes known as environmental and natural resources law, is a term used to explain regulations, statutes, local, national and international legislation, and treaties designed to protect the environment from damage and to explain the legal consequences of such damage towards governments or private entities or individuals. The term "environmental law" does not just cover government legislation. It can also describe a desire by businesses and other organizations, and their regulators to work towards improving ethical principles by setting regulation and industry standards for operating licenses.

Whichever way we look at it, environmental law affects all of us - individual health, business activity, geographical sustainability, and the importance of preserving those for the future generations and economy.

2.3. Laboratory waste management

Through the course of the lab operation there will be waste will be generated that can be harmful for the environmental. Laboratory waste is waste that is generated from laboratories in the mining sector. In order to contain such problems government and organization place a set of requirements for proper disposal of such waste.

Make sure the materials placed in the municipal waste are suitable for this type of disposal, especially:

- ✓ Do not place any liquids in the municipal waste.
- ✓ Do not dispose of chemical waste, including stock containers with unused product, in the municipal waste

All sharps must be in an appropriate, puncture-resistant container to prevent injuries.

If a material can be mistaken as a hazardous, radioactive, or biological waste, but is not, it must be identified as non-hazardous.

For all other types of waste, make sure the container is appropriately labeled and separated from municipal waste:

Hazardous waste - manage hazardous wastes in accordance with the Hazardous Materials Management and Disposal Policy and Procedures manual. This type of waste may only be removed by Environmental Health and Safety personnel.

Radioactive waste - manage radioactive wastes in accordance with the Radiation Safety Manual. This type of waste may only be removed by Environmental Health and Safety personnel.

Biological waste - manage biological wastes in accordance with the Biohazardous Waste and Sharps Disposal policy.

Sharps - " is defined as any object which could readily puncture or cut the skin of an individual, including,

- ✓ Needles,
- ✓ syringes,
- ✓ knives,
- ✓ razor blades,
- ✓ lancets,
- ✓ capillary tubes,
- ✓ metal shavings, etc.

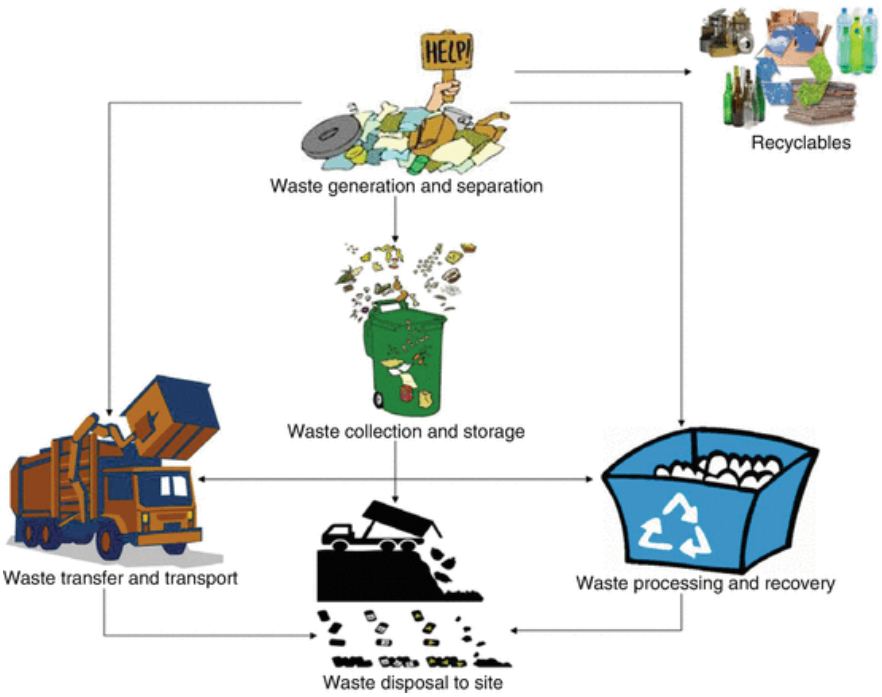


Fig 2.1 Recycling, waste management

2.4. water quality protection

Safe and clean water is necessary for human and environmental health and the nation's economic well-being.

The Organization have to play a key role in managing water pollution from nonpoint sources—such as runoff from farms, parking lots, or streets—which is the leading cause of pollution of the nation's waters. States set water quality standards, monitor water quality, and identify water bodies that do not meet their standards. For waters that do not meet water quality standards, states must develop Total Maximum Daily Loads (TMDL)—a pollutant budget—which EPA approves. EPA and the states then work to restrict pollution to these levels—for example, by providing incentives to landowners to reduce nonpoint source pollution.

Pollution of water protection of water from pollution

2.5. noise, vibration and dust management

- **Noise Control Measures**

Stationary plant such as generators will be located as far as practicably away from the nearest sensitive receptor;

All plant powered by combustion engines will be fitted with suitably maintained silencers;

Electrical or LPG powered plant will be used, where practicable, rather than plant owered bycombustion engine;

Plant will be used in accordance with the manufacturers' recommendations.

Plant such as mobile cranes which may be used intermittently will be shut down between workperiods or throttled down to a minimum;

Acoustic covers to engines will be kept closed when engines are in use

- **Vibration Control Measures**

Site personnel will be instructed in environmental matters and BPM to reduce noise and vibration.They will be informed in the site or laboratory area induction into the surrounding environment.

Hardcore matsutilised to absorb energy from demolition arisings

Loading of material into vehicles within designated bays only

Sensitive location of drop zones and loading areas

All deliveries to be scheduled to occur during daytime hours only and engines to be switched offwhen waiting

- **Dust control measures**

Erecting scaffolding and monarflex sheeting will confine the dust arisen during demolition works. Finewater spray techniques will continue to be deployed as they have been for the

duration of programmeto keep the dust to a minimum. The wheels of vehicles leaving site will be cleaned using a highpressure jet wash.

The following mitigation measures will be considered to minimise dust and other emissions from siteactivities and disruption or nuisance to neighbouring occupiers:

Spraying water at work faces, loading operations and site access roads;

Dampening of exposed soil and stockpiles if necessary;

The location of stockpiles of brick, concrete, soil and other materials away from dusts sensitive properties,

Regular inspection and cleaning of local highways and site boundaries for dust deposits;

Loading of material into lorries within designated bays/areas;

Hoarding around the site;

Sheeting of lorries leaving site carrying loose deconstruction material;

No unauthorised burning of any materials on site or aroun the laboratory; and

All site personnel trained in best practice for dust control by regular Environmental Toolbox talks.

2.6. Clean-up management

In general, most labware should be washed with detergent and water in the sink immediately after use to prevent the buildup of residue. Some chemicals, such as insoluble organic solutions, don't just need water and soap; they also require rinsing with ethanol or acetone to completely remove any remaining deposits.

2.7.The Environmental Policy of Ethiopia

The Environmental Policy of Ethiopia (1997) is the overarching policy for the environment and natural resource management in Ethiopia. It was developed to address an identified gap in the policy framework. The importance of sustainable development was recognised in national policy and laws however there was no overall comprehensive policy formulation to address the

cross-sectoral and sectoral issues that concern the environment and natural resource management. The Environmental Policy addresses this by setting out specific policy directives for different sectors concerning the environment and natural resource management as well as mining sector.

Self-Check – 2	Written test

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

2. Why do environmental protection law encourage recycling in waste disposal ?(5)

3.What is Enviromental Protection? Explan it Breifly (5)

Note: **Satisfactory rating - 10points** **Unsatisfactory - below 10 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet 3- Accessing, interpreting and applying relevant compliance documentation

3.1 Compliance documentation (Accessing, interpreting and applying)

Compliance documentation are the documents that must be completed in a job. These documents are required to show that the workplace is following the established laws, set practices and standards that must be in place.

Hence, Compliance documentation" means specific documents or information including records, reports, observations and verbal responses required to verify compliance with standards by a facility or program.

Failing to follow and work correctly with compliance documents may lead you to lose your job.

3. 2. Legislation

Legislation are the formal rules and laws set by governments.

The following regulations, procedures, standards and safety considerations may apply to planning and organize your work activities:

- Mining Act and Regulations (Mining Operation proclamation No.678/210 as Amended by proclamation No. 816/2013)
- Environmental Protection Act (1997)
- Equal Employment Opportunity and Disability Discrimination legislation
- Employment and workplace relations legislation
- Duty of care
- Code of Practice
- Occupational Health and Safety legislation
- Ethiopian Standards
- Manufacturer's specifications and recommendations
- Site specific regulations and procedures

Difference between an Act and a Regulation

An Act is passed by Parliament and provides the framework which deals with administration, management, inspection, areas of responsibility, duties and penalties, i.e. for Ministers, Inspectors, Mine Managers, Lab-Technicial. Acts are LAW.

Regulations are an Act passed by Parliament and details the specific elements, such as regulations concerning the use and operation of mobile lighting plant, the levels of a specific chemical that can be found in the air within a mine, etc. They are the minimum standard to be complied with. Regulations are also law

3.4. Employment conditions

Employment conditions are set by the award that is used in the laboratory.

Duties of workers

Through the awards, regulations and other forms of law broad expectations or duties of workers have been set. Any worker however regardless of the industry or laboratory they work in or where they are working, has a common set of duties:

- Take reasonable care for his or her own health and safety.
- Take reasonable care that his or her acts or omissions do not adversely affect the health and safety of other persons.
- Comply so far as the worker is reasonably able, with any reasonable instruction that is given by the person conducting the business or undertaking to allow the person to comply with the relevant legislation.
- Co-operate with any reasonable policy or procedure of the person conducting the business or undertaking relating to health or safety at the workplace that has been notified to workers.
- Identify and report risks and hazards.
- Use or wear appropriate personal protective equipment.
- Not intentionally misuse or cause damage to equipment.

Being accountable

Accountability is defined as "being responsible to somebody or for something".

In a work sense, accountability is about being true to your word and meeting all of your responsibilities. It is also about being true to yourself and your personal expectations of doing a good job.

Accountability is an individual value. Real accountability cannot be forced; it must be voluntary. Your accountability is really up to you, but you will be judged by other workers and the bosses on how you demonstrate your accountability.

There are three elements to personal accountability:

- ✓ Honest
- ✓ Responsibility
- ✓ Assertiveness

Equal Opportunity

Equal Opportunity can deliver financial and human advantages to the business and workplace." Equal Opportunity means delivering fair outcomes to the staff and customers. It also means you have to prevent discrimination, harassment, bullying and victimisation.

Self-Check – 3	Written test

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

TEST I

1. Discus what compliance documentation is? (4 points)

2. Discuss briefly the consequences of failing to follow and work correctly with compliance documents. (2 points)

3. What is the current legislation that covers the environmental protection within your state or (2 points)

4. What is meant by the term 'obligation'?(2 points)

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet 4-Obtaining, confirming and applying work instructions

4.1. work instructions

A work instruction is a tool provided to help someone to do a job correctly. This simple statement implies that the purpose of the work instruction is quality and that the target user is the worker. Generally, A Work Instruction is a document that provides specific instructions to carry out an Activity. It is a step by step guide to perform a single instruction. A Work Instruction contains more detail than a Procedure and is only created if detailed step-by-step instructions are needed.

When planning any work you must take into account your duty of care obligations and the policy and procedures of your workplace.You must make sure your conduct is safe and does not place others at risk. The task requirements will be outlined in your work instructions for that job. Generally these instructions will be provided by your immediate supervisor, the team leader, lab- Technicial.

Forms of instruction

Work instructions can be received by you or your work team in several different ways. The most common ways of receiving work instructions in a mining or Laboratory are:

Written documentation

A written document means a document with text that provides information on an official work related matter. It may include reports, memos, letters, manuals, service standards and directives.

Verbal instructions

Verbal instructions are the instructions, directions and orders that are given to you through voice, i.e. the boss tells you what to do!

Team meetings

A team meeting is when the members of your work team are gathered together to receive instructions about the work tasks, report back on the team's progress on various jobs and to learn about what is happening in the immediate future on the work site.

Self-Check – 5	**Written test**

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1.What is work instruction? Explain it briefly(5)

2. List and Explain form of Instruction (5)

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet 5- Obtaining, confirming and applying the site safety plan and Safety requirements

5.1 Laboratory Safety Plans

laboratory safety plan is a document that describes the general rules of conduct and other information useful in helping to prevent laboratory incidents and to appropriately respond to any incidents that may occur. A laboratory safety plan is appropriate for those labs where chemical usage is minimal to non-existent.

“Laboratory Safety Plans” for individual laboratories are required by the Occupational Safety and Health Administration (OSHA) regulation, “Occupational Exposures to Hazardous Chemicals in Laboratories,” commonly referred to as the OSHA Laboratory Standard. This standard requires a written plan that sets forth procedures, equipment, personal protective equipment and work practices capable of protecting employees from health hazards presented by the chemicals used in the laboratory.

At typical laboratory the complete lab safety plan consists of two components:

1.The Laboratory Safety Manual, which covers general safety procedures for organization laboratories, And a

2. Laboratory Safety Plan” prepared by the Principal Investigator to address hazards and precautions specific to a given laboratory.

The “Laboratory Safety Plan

identifies the hazards in the laboratory

describes specific handling procedures and precautions for special hazards

outlines emergency safety procedures in the event of a fire or chemical spill

The “Laboratory Safety Manual” and “Laboratory Safety Plan” must be available to all employees in the laboratory; the contents of these documents must be discussed with each employee when he or she begins working in a laboratory andannually there after.

The “Laboratory Safety Plan” is divided into sections, each of which deal with a particular aspect of laboratory safety, including hazardous materials, radioactive materials, x-ray equipment, lasers, and chemical hazards.

Instructions for the preparation of “Laboratory Safety Plans” are found in the followinglink of the “Laboratory Safety Manual“.

5.2 Safety requirements

Laboratory Safety is a very important aspect of science. Without it, experimentation could result in very serious injury, if not death, of course. To reduce the risks involved with experimentation, there are certain procedures that we should all follow as individuals and as a member of a group

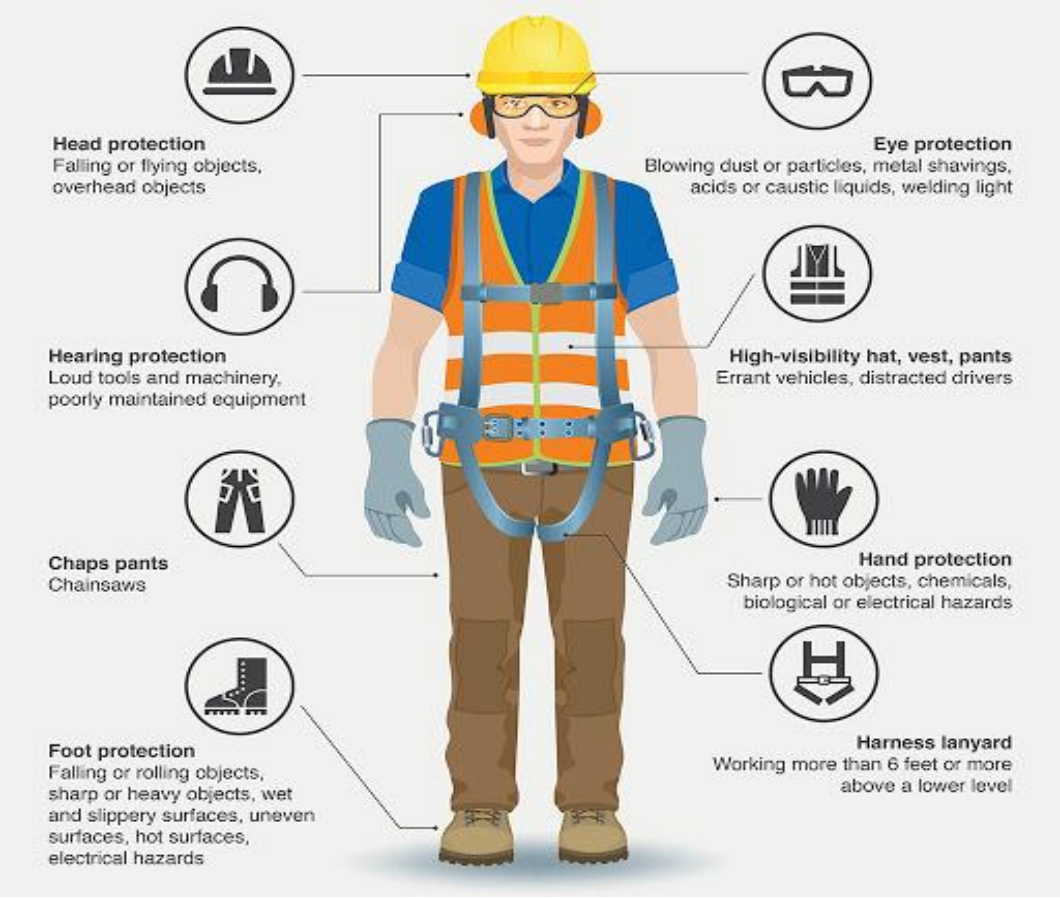
So, Safety Requirement of Laboratory may include The following

- protective clothing and equipment
- use of tools and equipment
- workplace environment and safety
- handling of materials
- use of fire fighting equipment
- use of First Aid equipment
- hazards and risks control,

5.2.1.protective clothing and equipment

Personal protective equipment is protective clothing, helmets, goggles, or other garments or equipment designed to protect the wearer's body from injury or infection. The hazards

addressed by protective equipment include physical, electrical, heat, chemicals, biohazards, and airborne particulate matter.



5.2.2.Use of tools and equipment

The uses of tools and equipments are listed below.

Picture	Name	Use

	Polarizing Microscopes	to examine chemicals, rocks, and minerals.
	Cover Slip	Used to cover specimens on a microscope slide.
	Beaker	Used to hold, mix, and heat liquids..
	Hot Plate	An electrical device used to heat things up.
	Beaker Tongs	Used to handle hot beakers.
	Bunsen Burner	Frequently used as a heat source in the absence of flammable.
	sample dividers and sieve shakers	Used to particle size analysis.
	Test Tube	Used to mix, heat, or store substances.
	Test Tube Rack	Used to hold test tubes.
	Test Tube Brush	Used to clean test tubes.
	Funnel	Aids in pouring liquids into small openings without spilling them.
	crushers and grinders	Used for milling the sample.
	Meter Stick	Used to measure length in the Metric System. One meter = 10 dm or 100 cm or 1000 mm.

	Oven	Used to dry sample
	XRF	Used to examine the geochemistry of the sample.
	Triple Beam Balance	Used to measure mass in grams.
	Thermometer	Used to measure temperature in degrees Celsius or Fahrenheit.
	Safety Goggles	To be worn when told to do so to protect your eyes.
	Ring Clamp	Used to clamp onto a ring stand to sit a beaker or flask.

5.2.3. workplace environment and safety

Workplace safety refers to the working environment at a company and encompasses all factors that impact the safety, health, and well-being of employees. This can include environmental hazards, unsafe working conditions or processes, drug and alcohol abuse, and workplace violence.

5.2.3. Handling of materials

- ✓ **Avoid lifting materials from the floor or while seated**.
- ✓ Make use of available handling aids.

- ✓ Refrain from using sudden or jerky movements.
- ✓ Never lift a load over an obstacle.
- ✓ Perform lifts in areas with adequate footing, space and lighting.
- ✓ Modify objects and redesign jobs to make moving easier.

5.2.4.Materials Handling Safety Procedures

Maintain the correct posture: avoid bending over and keep lifts close to the body.

Lift in a careful, deliberate manner and avoid any sudden lift movements.

Never lift materials from a sitting position, or twist to pick up a heavy object.

Wear appropriate personal protective equipment, such as a hard hat, safety shoes, gloves and glasses.

Provide and maintain clean, clear access to warehouses, storage areas and stored materials. Keep aisles, travelways and exits clear and free of slip, trip and strike-against hazards

5.2.5.use of fire fighting equipment

Using a fire extinguisher

Firefighting Equipment is the main firefighter equipment used to extinguish fires, including fire fighting hose, portable fire pumps, fire hose reels, fire monitors and fire fighting nozzles.

Pull: Pull the pin, this will break the tamper seal.

Aim: Aim low, pointing the nozzle or hose at the base of the fire. ...

Squeeze: Squeeze the handle to release the extinguishing agent.

Sweep: Sweep from side to side at the base of the fire, the fuel source, until the fire is out.

5.2.6.use of First Aid equipment

A first aid kit is a collection of supplies and equipment that is used to give medical treatmen.

Administering first aid to bleeding or wounded casualties. Administering first aid for scalds/burns, bone/muscle injuries, shock, eye injuries, poisonings, casualties overcome by gas or fumes.

It is usually used for treating these types of minor traumatic injuries:

- ✓ Burns.
- ✓ Cuts.
- ✓ Abrasions (scrapes)
- ✓ Stings.
- ✓ Splinters.
- ✓ Sprains.
- ✓ Strains.

5.2.7.hazards and risks control

Hazards and risks Control measures include actions that can be taken to reduce the potential of exposure to the hazard, or the control measure could be to remove the hazard or to reduce the likelihood of the risk of the exposure to that hazard being realised

It including:

uneven/unstable terrain

trees

fires

buildings,

hazardous materials and substances

worksite visitors and

safe operating procedures

personnel restricted access barriers

working at heights

working in proximity to others

emergency procedures, including:

emergency shutdown and stopping

extinguishing equipment fires

organisational First Aid requirements and etc.

Self-Check – 5	Written test

Directions:

Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I

What is laboratory safety plan (5)

Explain safety Requirements?(3)

Note: **Satisfactory rating – 8 points** **Unsatisfactory - below 8 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet 6- Selecting Plant, tools and equipment

6.1. Equipment

Laboratory equipment refers to the various tools and equipment used by Geologist or scientists working in a laboratory: The classical equipment includes tools such as Bunsen burners and microscopes etc. Let us see one by one

Generator

A generator is a device that converts motive power into electrical power for use in an external circuit. Sources of mechanical energy include steam turbines, gas turbines, water turbines, internal combustion engines, wind turbines and even hand cranks.

Fig 6.1 generator

Compressor

A compressor is a mechanical device that increases the pressure of a gas by reducing its volume. An air compressor is a specific type of gas compressor. Compressors are similar to pumps: both increase the pressure on a fluid and both can transport the fluid through a pipe

Fig 6.2 Compressor

inverter

A power inverter, or inverter, is a power electronic device or circuitry that changes direct current to alternating current. The resulting AC frequency obtained depends on the particular device employed.

Fig 6.3

Solar

Solar energy is radiant light and heat from the Sun that is harnessed using a range of ever-evolving technologies such as solar heating, photovoltaics, solar thermal energy, solar architecture, molten salt power plants.

Fig 6.4 solar

Concrete equipment.

1. **Concrete batching** plant Concrete batching plants basically used to process the materials to form concrete. It mixes all the materials like sand, gravels, cement and water to form a better solution that should be sent to construction site.

2. Concrete crusher Concrete crushers have two types: one is mobile concrete crusher similar like a bulldozer but has an attachment with its boom arm use to crush the big rock pieces into small gravels but second type mostly can be seen in the industries used for crushing medium sized rocks into powder or gravel form. These concrete crushers are considered as best source for saving labor cost and time.

3. Concrete mixer Concrete mixer is best source for the constructors that want to save their precious raw material from wastage that can't be tolerated. Concrete mixers used to mix all

the elements like cement, gravel and water for better mixing and it also saves the time because of its high efficiency while working.

Excavation equipment

There are different types of soil excavation tools and machines used in construction and samplind for the Laboratory test purrpose. Excavation of soil is necessary in construction point of view and it should be done by hand tools or machineries based on the area of the land or depth of excavation. By the process of excavation, the land is cleaned from tree roots, strums, organic impurities etc., which should harm to the foundation.

Types of Soil Excavation Tools and Machines:

Now a days, for the soil excavation there are so many equipment's are there and these are classified into two types.

1. Hand tools

2. Machineries

Hand tools for Soil Excavation:

These are generally used for smaller depths of excavations in small areas. Man power is required to operate these tools.

Shovel

Shovel is tool which is used for the purpose of lifting of excavated soil. It is

also similar to spade the difference between spade and shovel is the difference in leading edge. The curvature of metal plate of shovel is generally higher when compared to spade so we can hold the soil easily and lifted it. Shovel can also be used for digging purpose in case of soft soils, sand etc.

Rake

Rake is a tools which is having a horizontal rod having metal teeth and is used to remove the small layers of soil.

Pick axe

Pick axe consists hard spike attached perpendicular to handle. They are used for excavating small trenches in soil. Pick axe can cut the soil even if the soil is of hard type. The metal spike is pointed on one side and wide blade is provided on the other side.

Machinery Tools for Soil Excavation:

These are the tools which are operated by mechanical force and are used for the larger depths of excavations. There are so many types of machine tools with ease of operation are designed in this modern day period.

jackhammer

is a pneumatic or electro-mechanical tool that combines a hammer directly with a chisel. It was invented by William Mcreavy, who then sold the patent to Charles Brady King. Hand-held jackhammers are generally powered by compressed air, but some are also powered by electric motors.

Post hole borer

A post hole digger is a tool used to dig narrow holes to install posts, such as for fences and signs.There are different kinds of post hole diggers. A post hole pincer (pictured) is jabbed into the ground in the open position until the blades are buried. At that point the handles are pulled apart to close the tool and grab the chunk of soil loosened. They are then pulled out of the ground with the chunk of soil. The process is repeated until the hole

is deep enough, or until the hole is so deep and narrow that the handles can no longer be pulled apart fully. This is one of the weaknesses of this kind of post hole digger.

Water equipment

Pumps

A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps can be classified into three major groups according to the method they use to move the fluid: direct lift, displacement, and gravity pumps.

Pumps operate by some mechanism (typically reciprocating or rotary), and consume energy to perform mechanical work moving the fluid. Pumps operate via many energy sources, including manual operation, electricity, engines, or wind power, come in many sizes, from microscopic for use in medical applications to large industrial pumps.

Water pump

pressure cleaner

Pressure washers are part garden hose and part air compressor. A typical pressure washer has either a gas-fueled engine or electrical powered motor that powers a water pump. The pump accelerates the water, supplied from a garden hose, to produce high pressure. The washer is hooked to a high pressure- rated hose.

Lighting equipment

Mobile lighting plant

light tower is a piece of mobile equipment which has one or more high-intensity electric lamps and a mast. Almost always, the lights are attached to the mast, which is attached to a trailer, with a generator set to power the lamps. Normally the lamps are metal halide bulbs and the generator is powered by a diesel engine. However, battery-powered, solar-powered and hydrogen-powered sets are available; light towers with electrodeless lamps lighting are also sold.

Lifting and materials includes

pedestrian forklift

pallet trolleys

Hoist

Self-Check – 6	Written test

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

list three types of pumps?(3)

List and Explain Laboratory Equipment?(4)

Note: **Satisfactory rating - 7 points** **Unsatisfactory - below 7 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Information Sheet 7- Characterization of basic soil types

7.1 Soil Characteristics

Soil is a mixture of organic matter, minerals, gases, liquids, and organisms that together support life. Earth's body of soil, called the pedosphere, has four important functions: as a medium for plant growth. as a means of water storage, supply and purification. as a modifier of Earth's atmosphere. There are seven soil characteristics that are used to classify the soil: composition, color, texture, structure, soil water, organic matter and chemistry. Each one of them are described briefly below.

7.1.1. Composition

The composition of the soil is placed into four different categories: inorganic material, organic material,water and air. Inorganic material is any compound that is not derived from animal or plant sources. Carbon atoms are not present in inorganic compounds. Organic material is composed of animal and plant sources. Carbon atoms are present in organic compounds. The amount of water and air particles that are present in the soil will also determine it's composition.

7.1.2 Color

The color of the soil is another way to characterize soil. Soil that is black or a rich, deep brown is high in organic content. This soil is very fertile and is ideal for planting and farming. The nutrients in the soil are rich. Yellow, red, or orange soil indicates that it is rich in iron. Soil that has a light gray or white tint has a lot of calcium or silica.

7.1.3 Texture

The texture is the feel of the soil and generally refers to the clay, silt and sand content. There is a texture triangle that scientists use to determine the characteristics of soil. According to the texture triangle, the soil is considered clay if it is less than 0.002 mm. It is silt if the soil is between 0.002 and 0.05 mm. The texture is sand if it is between 0.05 and 2.0 mm.

7.1.4 Structure

Structure is the shape, size and organization of peds. A ped is a soil particle. Soil that has particles that are horizontal, plate-like or flat are called platy. Soil with long, vertical particles that are bound by flat or slightly rounded vertical faces are prismatic and columnar. Particles that are block-like or somewhat square are called blocky. Small, rounded particles are granular.

7.1.5 Soil Water

Soil water means the infiltration which includes the rate and capacity. How fast the water moves through the soil and how much water the soil can hold at saturation level will help determine the type of soil. There are several forms of soil water and includes gravity water, capillary water, field capacity, wilting point, hygroscopic water and the available water capacity.

7.1.6 Organic Matter

Organic matter can be categorized into two forms: litter and humus. Litter also referred to as litterfall, plant litter, tree litter, soil litter or duff. This refers to dead plant materials that are on the ground and provides nutrients to the top layer of the soil. Humus is any organic materials that are stable, they will no longer break down and will remain in their current state for several thousand years.

7.1.7 Chemistry

Soil is classified by the acidity and alkalinity of the matter. It is measured in pH units and is determined by the amount of hydrogen ion concentration within the soil. The pH measurements are on a scale from 0 to 14, a pH of 7 means that it is neutral. A pH level of 0 to 7 measures the acidity of the soil. A pH level of 7 to 14 measures the alkalinity of the soil.

Self-Check – 7	Written test

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

In which character of soil we study soil acidity? (2)

Note: Satisfactory rating - 2points Unsatisfactory - below 2 points

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

InformationSheet 8-Identifying, confirming and applying project environmental management plan

8.1 ENVIRONMENT MANAGEMENT PLAN

The Environment Management Plan (EMP) would consist of all mitigation measures for each component of the environment due to the activities increased during the construction, operation and the entire life cycle to minimize adverse environmental impacts resulting from the activities of the project. It would also delineate the environmental monitoring plan for compliance of various environmental regulations. It will state the steps to be taken in case of emergency such as accidents at the sites including fire. The detailed EMP for the complex is given below.

The Environment Management Plan (EMP) is a site specific plan developed to ensure that the project is implemented in an environmental sustainable manner where all stakeholders involved in the project, including consultants, understand the potential environmental risks arising from the project and take appropriate actions to properly manage that risk. EMP also ensures that the project implementation is carried out in accordance with the design by taking appropriate mitigation actions to reduce adverse environmental impacts during its life cycle. The plan outlines existing and potential problems that may adversely impact the environment and recommends corrective measures where required. Also, the plan outlines roles and responsibility of the key personnel and contractors who will be in-charge of the responsibilities to manage the project site.

EMP includes four major elements

Commitment & Policy: The management will strive to provide and implement the Environmental Management Plan that incorporates all issues related to air, water, land and noise.

Planning: This includes identification of environmental impacts, legal requirements and setting environmental objectives.

Implementation: This comprises of resources available to the Society, accountability of contractors, training of operational staff associated with environmental control facilities and documentation of measures to be taken.

Measurement & Evaluation: This includes monitoring, counteractive actions and record keeping.

It is suggested that as part of the EMP, a monitoring committee would be formed Ethiopian government comprising of the site in-charge/coordinator, environmental group representative and project implementation team representative. The committee's role would be to ensure proper operation and management of the EMP including the regulatory compliance.

Self-Check – 8	**Written test**

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1. what are the major element of environmental management plan?? (2)

Note: Satisfactory rating - 2points Unsatisfactory - below 2 points

You can ask you teacher for the copy of the correct answers.

InformationSheet 9- Materials Safety Data Sheets (MSDS)and materials handling methods

Materials Safety Data Sheets (MSDS)

A material safety data sheet is a technical document which provides detailed and comprehensive information on a controlled product related to:

health effects of exposure to the product

hazard evaluation related to the product's handling, storage or use

measure to protect workers at risk of exposure

emergency procedures.

The data sheet may be written, printed or otherwise expressed, and must meet the availability, design and content requirements of WHMIS legislation. The legislation provides for flexibility of design and wording but requires that a minimum number of categories of information be completed and that all hazardous ingredients meeting certain criteria be listed subject to exemptions granted under the Hazardous Materials Information Review Act. The Purpose of the Data Sheet The data sheet is the second element of the WHMIS information delivery system and is intended to supplement the alert information provided on labels.

Material Handling

"Material handling embraces the basic operations in connection with the movement of bulk, packaged and individual products in a semi-solid or solid state by means of gravity manually or power-actuated equipment and within the limits of individual producing, fabricating, processing or service establishment". Material handling does not add any value to the product but adds to the cost of the product and hence it will cost the customer more. So the handling should be kept at minimum.

MATERIAL HANDING EQUIPMENTS

Broadly material handling equipment's can be classified into two categories, namely:

(a) Fixed path equipments, and

(b) Variable path equipments.

(a) Fixed path equipments which move in a fixed path. Conveyors, monorail devices, chutesand pulley drive equipments belong to this category. A slight variation in this category isprovided by the overhead crane, which though restricted, can move materials in anymanner within a restricted area by virtue of its design. Overhead cranes have a verygood range in terms of hauling tonnage and are used for handling bulky raw materials,stacking and at times palletizing.

(b) Variable path equipments have no restrictions in the direction of movement althoughtheir size is a factor to be given due consideration trucks, forklifts mobile cranes

andindustrial tractors belong to this category. Forklifts are available in many ranges, they aremanoeuvrable and various attachments are provided to increase their versatility.

Material Handing Equipments may be classified in five major categories.

1. Conveyors

Conveyors are useful for moving material between two fixed workstations, either continuously or intermittently. They are mainly used for continuous or mass production operations—indeed, they are suitable for most operations where the flow is more or less steady. Conveyors may be of various types, with rollers, wheels or belts to help move the material along: these may be power-driven or may roll freely.

2. Industrial trucks

Industrial trucks are more flexible in use than conveyors since they can move between various points and are not permanently fixed in one place. They are, therefore, most suitable for intermittentpetrol-driven, electric, hand-powered, and so on. Their greatest advantage lies in the wide range of attachments available; these increase the trucks ability to handle various types and shapes of material.

3. Cranes and hoists

The major advantage of cranes and hoists is that they can move heavy materials through overhead space. However, they can usually serve only a limited area. Here again, there are several types of crane and hoist, and within each type there are various loading capacities. Cranes and hoists may be used both for intermittent and for continuous production.

4. Containers

These are either ‘dead’ containers (e.g. Cartons, barrels, skids, pallets) which hold the material to be transported but do not move themselves, or ‘live’ containers (e.g. wagons,

wheelbarrows or computer self-driven containers). Handling equipments of this kind can both contain and move the material, and is usually operated manually.

Self-Check – 9	Written test

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

Describe the content of Materials Safety Data Sheets (MSDS) (2)

Note: Satisfactory rating - 2points Unsatisfactory - below 2 points

You can ask you teacher for the copy of the correct answers.

InformationSheet 10- Job Safety Analysis (JSA)

1. Job Safety Analysis (JSA)

A job safety analysis (JSA) is a procedure which helps integrate accepted safety and health principles and practices into a particular task or job operation. In a JSA, each basic step of the job is to identify potential hazards and to recommend the safest way to do the job. Other terms used to describe this procedure are job hazard analysis (JHA) and job hazard breakdown.

The terms "job" and "task" are commonly used interchangeably to mean a specific work assignment, such as "operating a grinder,""using a pressurized water extinguisher" or "changing a flat tire." JSAs are not suitable for jobs defined too broadly, for example, "overhauling an engine"; or too narrowly, for example, "positioning car jack."

2. Application of JSA

A JSA is a documented risk assessment developed when company policy directs employees to do so. Workplace hazard identification and an assessment of those hazards may be required before every job.JSAs are usually developed when directed to do so by a supervisor, when indicated by the use of a first tier risk assessment and when a hazard associated with a task has a likelihood rating of 'possible' or greater.Generally, high consequence, high likelihood task hazards are addressed by way of a JSA.These may include,

A history of, or potential for, injury, harm or damage such as those involving:

1. Fire, chemicals or a toxic or oxygen deficient atmosphere.

2. Tasks carried out in new environments.

3. Rarely performed tasks.

4. Tasks that may impact on the integrity or output of a processing system.

It is important that employees understand that it is not the JSA form that will keep them safe on the job, but rather the process it represents. It is of little value to identify hazards and devise controls if the controls are not put in place. Workers should never be tempted to "sign on" the bottom of a JSA without first reading and understanding it.

JSAs are quasi-legal documents, and are often used in incident investigations, contractual disputes, and court cases.

3. Structure of JSA

The JSA or JHA is usually created by the work group who will perform the task. The more minds and experience applied to analysing the hazards in a job, the more successful the work group is likely to be in controlling them. Sometimes it is expedient to review a JSA that was prepared when the same task was performed on a previous occasion, but care should be taken to ensure that all of the hazards for the job are controlled for the new occasion. The JSA is usually recorded in a standardised tabular format with three to as many as five or six columns.[clarification needed] The headings of the three basic columns are: Job step, Hazard and Controls. A Hazard is any factor that can cause damage to personnel, property or the environment (some companies include loss of productionor downtime in the definition as well). A Control is any process for controlling a hazard. The job is broken down into its component steps. Then, for each step, hazards are identified. Finally, for each hazard identified, controls are listed.

Application of the JSA

After the JSA worksheet is completed, the work group that is about to perform the task would have a toolbox talk, to discuss the hazards and controls, delegate responsibilities, ensure that all equipment and personal protective equipment described in the JSA are available, that contingencies such as fire fighting are understood, communication channels and hand signals are agreed etc. Then, if everybody in the work group agrees that it is safe to proceed with the task, work can commence.

If at any time during the task circumstances change, then work should be stopped (sometimes called a "time-out for safety"), and the hazards and controls described in the JSA should be reassessed and additional controls used or alternative methods devised. Again, work should only continue when every member of the work group agrees it is safe to do so.

When the task is complete it is often of benefit to have a close-out or "tailgate" meeting, to discuss any lessons learned so that they may be incorporated into the JSA the next time the task is undertaken.

Self-Check – 10	Written test

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1.what is the application of JSA?(2)

2.What does the JSA contains?(2)

Note: Satisfactory rating - 4points Unsatisfactory - below 4 points

LG #51	LO #2- Conduct pre-operational checks

Instruction sheet

- Applying manufacturers manual
- Identifying required materials
- Selecting Fuel and lubricants
- Checking and adjusting fuel, oil, hydraulic fluid and water levels
- Securing/tightening and maintaining bolts, nuts, guards and attachment couplings
- Checking and adjusting function of controls and gauges
- Applying operator's manual to start-up and shutdown

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Applying manufacturers manual
- Identifying required materials
- Selecting Fuel and lubricants
- Checking and adjusting fuel, oil, hydraulic fluid and water levels
- Securing/tightening and maintaining bolts, nuts, guards and attachment couplings
- Checking and adjusting function of controls and gauges
- Applying operator's manual to start-up and shutdown

Read the specific objectives of this Learning Guide.

Follow the instructions described below 3 to 7

Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.

Accomplish the “Self-checks” which are placed following all information sheets.

Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).

If you earned a satisfactory evaluation proceed to “Operation sheets

Perform “the Learning activity performance test” which is placed following “Operation

sheets” ,

If your performance is satisfactory proceed to the next learning guide,

If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information Sheet 1- Applying manufacturers manual

1.1 Manufacturers manual

Manual (also called an instruction manual or a user guide) is an instructional book or booklet that is supplied with almost all technologically advanced consumer products such as vehicles, home appliances and computer peripherals. Information contained in the owner's manual typically includes:

Safety instructions; for liability reasons these can be extensive, often including warnings against performing operations that are ill-advised for product longevity or overall user safety reasons.

Assembly instructions; for products that arrive in pieces for easier shipping.

Installation instructions; for products that need to be installed in a home or workplace.

Setup instructions; for devices that keep track of time or which maintain user accessible state.

Instructions for normal or intended operations.

Programming instructions; for microprocessor controlled products such as VCRs, programmable calculators, and synthesizers.

Maintenance instructions.

Troubleshooting instructions; for when the product does not work as expected.

Service locations; for when the product requires repair by a factory authorized technician.

Regulatory code compliance information; for example with respect to safety or electromagnetic interference.

Product technical specifications.

Warranty information; sometimes provided as a separate sheet.

Self-Check – 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

how should we follow operational manual? (3pts)

Note: Satisfactory rating - 3 points Unsatisfactory - below 3points

Score = _____

Rating: _____

You can ask you teacher for the copy of the correct answers.

Answer sheet

Test I

1._____

Information Sheet 2- Identifying required material

2.1 Material

A material is a substance or mixture of substances that constitutes an object. Materials can be pure or impure, living or non-living matter. Materials can be classified based on their physical and chemical properties, or on their geological origin or biological function.

These materials make up the objects around us, and each of these materials has different properties or characteristics that can be observed or tested. Scientists, technologists and engineers investigate these materials – they experiment with them, compare their properties and relate the results to possible uses.

It is important to decide if you are investigating the properties of a material or of an object.

It may includes:

Water

Water, a substance composed of the chemical elements hydrogen and oxygen and existing in gaseous, liquid, and solid states. It is one of the most plentiful and essential of compounds. A tasteless and odourless liquid at room temperature, it has the important ability to dissolve many other substances

Clays, silts, stone, gravel, mud, rocks and, topsoil

These are an aggregative rocks that is found in different area and ration

Bituminous mixes

sometimes called asphalt mixtures, are blends of aggregates with different gradations, filler type and content and hardness with bitumen of different grades and quantities.

Timber

wood which has been processed into beams and planks.

Fuels and oils

consisting mainly of residues from crude-oil distillation. It is used primarily for steam boilers in power plants, aboard ships, and in industrial plants. Commercial fuel oils usually are blended with other petroleum fractions to produce the desired viscosity and flash point.

power leads

A power cord, line cord, or mains cable is an electrical cable that temporarily connects an appliance to the mains electricity supply via a wall socket or extension cord. The terms are generally used for cables using a power plug to connect to a single-phase alternating current power source at the local line voltage.

Replacement parts and consumables

Consumables are those which are not replaced or which are finished during the process. For ex. Oil, Hand Gloves, Coolant etc. Spares are those which are replaced and doesn't vanishes from the machine during process.

replacement, is an interchangeable part that is kept in an inventory and used for the repair or replacement of failed units.

Self-Check – 2	**Written test**

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Question

How can we classify materials??(3pts)

Note: Satisfactory rating - 3 points Unsatisfactory - below 3points

Score = _____

Rating: _____

Answer sheet

Test I

1._____

Information Sheet 3- Selecting Fuel and lubricants

3.1.Fuels

A fuel is any material that can be made to react with other substances so that it releases energy as heat energy or to be used for work. The concept was originally applied solely to those materials capable of releasing chemical energy but has since also been applied to other sources of heat energy such as nuclear energy (via nuclear fission and nuclear fusion).

3.2.Solid fuel

Solid fuel refers to various types of solid material that are used as fuel to produce energy and provide heating, usually released through combustion. Solid fuels include wood , charcoal, peat, coal, hexamine fuel tablets, and pellets made from wood (see wood pellets), corn, wheat, rye and other grains. Solid-fuel rocket technology also uses solid fuel (see solid propellants). Solid fuels have been used by humanity for many years to create fire. Coal was the fuel source which enabled the industrial revolution, from firing furnaces, to running steam engines. Wood was also extensively used to run steam locomotives. Both peat and coal are still used in electricity generation today. The use of some solid fuels (e.g. coal) is restricted or prohibited in some urban areas, due to unsafe levels of toxic emissions. The use of other solid fuels as wood is decreasing as heating technology and the availability of good quality fuel improves.

Liquid fuels

Liquid fuels are combustible or energy-generating molecules that can be harnessed to create mechanical energy, usually producing kinetic energy; they also must take the shape of their container. It is the fumes of liquid fuels that are flammable instead of the fluid.

Most liquid fuels in widespread use are derived from the fossilized remains of dead plants and animals by exposure to heat and pressure inside the Earth's crust. However, there are several types, such as hydrogen fuel (for automotive uses), ethanol, jet fuel and bio-diesel which are all categorized as a liquid fuel. Emulsified fuels of oil-in-water such as orimulsion have been developed a way to make heavy oil fractions usable as liquid fuels. Many liquid fuels play a primary role in transportation and the economy.

Some common properties of liquid fuels are that they are easy to transport, and that can be handled easily. Also they are relatively easy to use for all engineering applications, and

home use. Fuels like kerosene are rationed in some countries, for example available in government subsidized shops in India for home use.

Lubrication

A lubricant is a substance, usually organic, introduced to reduce friction between surfaces in mutual contact, which ultimately reduces the heat generated when the surfaces move. It may also have the function of transmitting forces, transporting foreign particles, or heating or cooling the surfaces. The property of reducing friction is known as lubricity.

In addition to industrial applications, lubricants are used for many other purposes. Other uses include cooking (oils and fats in use in frying pans, in baking to prevent food sticking), bioapplications on humans (e.g. lubricants for artificial joints), ultrasound examination, medical examination. It is mainly used to reduce friction and to contribute to a better and efficient functioning of a mechanism.

Properties

A good lubricant generally possesses the following characteristics:

A high boiling point and low freezing point (in order to stay liquid within a wide range of temperature)

- ✓ A high viscosity index
- ✓ Thermal stability
- ✓ Hydraulic stability
- ✓ Demulsibility
- ✓ Corrosion prevention
- ✓ A high resistance to oxidation

Functions of lubricants

One of the single largest applications for lubricants, in the form of motor oil, is protecting the internal combustion engines in motor vehicles and powered equipment

Keep moving parts apart

Lubricants are typically used to separate moving parts in a system. This separation has the benefit of reducing friction, wear and surface fatigue, together with reduced heat generation, operating noise and vibrations. Lubricants achieve this in several ways. The most common is by forming a physical barrier i.e., a thin layer of lubricant separates the moving parts. This is analogous to hydroplaning, the loss of friction observed when a car tire is separated from the road surface by moving through standing water.

Reduce friction

Typically the lubricant-to-surface friction is much less than surface-to-surface friction in a system without any lubrication. Thus use of a lubricant reduces the overall system friction. Reduced friction has the benefit of reducing heat generation and reduced formation of wear particles as well as improved efficiency. Lubricants may contain additives known as friction modifiers that chemically bind to metal surfaces to reduce surface friction even when there is insufficient bulk lubricant present for hydrodynamic lubrication, e.g. protecting the valve train in a car engine at startup.

Transfer heat

Both gas and liquid lubricants can transfer heat. However, liquid lubricants are much more effective on account of their high specific heat capacity. Typically the liquid lubricant is constantly circulated to and from a cooler part of the system, although lubricants may be used to warm as well as to cool when a regulated temperature is required.

Transmit power

Lubricants known as hydraulic fluid are used as the working fluid in hydrostatic power transmission. Hydraulic fluids comprise a large portion of all lubricants produced in the world. The automatic transmission's torque converter is another important application for power transmission with lubricants.

Protect against wear

Lubricants prevent wear by keeping the moving parts apart. Lubricants may also contain anti-wear or extreme pressure additives to boost their performance against wear and fatigue.

Prevent corrosion

Many lubricants are formulated with additives that form chemical bonds with surfaces or that exclude moisture, to prevent corrosion and rust. It reduces corrosion between two metallic surface and avoids contact between these surfaces to avoid immersed corrosion.

Seal for gases

Lubricants will occupy the clearance between moving parts through the capillary force, thus sealing the clearance. This effect can be used to seal pistons and shafts.

Self-Check – 3	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1. What is the major use of fuels? (3pts)

Note: Satisfactory rating - 3 points Unsatisfactory - below 3 points

Score = _____

Rating: _____

Information Sheet 4- Checking and adjusting fuel, oil, hydraulic fluid and water levels

4.1. Mobile plant Hydraulic system

Half of the battle in hydraulic system troubleshooting is knowing exactly what 'normal' is. It's hard to diagnose a component or a section of a system without knowing normal parameters, such as:

- ✓ Speeds
- ✓ Pressure
- ✓ Valve response times
- ✓ Sounds
- ✓ Vibrations
- ✓ Heat levels, etc.

The other half of the battle is preventing breakdowns from occurring in the first place. But again, 'normal' is the reference and the intended operational state. Proper hydraulic system maintenance conducted at the right time should keep a mobile machine in normal or optimal condition. The value of careful observation of a machine in operation cannot be overstated. For machines with a hydraulic system such as a loader, grader, vacuum truck, or a recycling truck, regular care is a must. For an excavator or a skid steer loader that is entirely operated by hydraulics, preventative maintenance work is truly job critical.

At minimum, fundamental care and maintenance of the mobile hydraulic system should address the following major areas

1.Levels:-Maintaining the level of fluid in the hydraulic reservoir is about much more than just making sure that there is enough liquid volume to supply all cylinders at full extension. The surplus volume also provides cooling, allows for a minor amount of air bubbles that may have entered the system to dissipate, and perhaps allows some solid particles (not yet trapped by a filter) to settle out in front of the tank baffle as the fluid returns from the work application circuits.Failing to keep the reservoir at the correct level can invite condensation to accumulate on the exposed inner surfaces, and drip down into the hydraulic fluid. If the operating environment is humid or moist, a desiccant breather or a vacuum-breaker style of breather/fill cap will be helpful.Be sure to check the normal fill level when all single rod cylinders are retracted and with the brake or steering accumulators bled back to tank.

Does your machine feature an electronic pilot control system? If so, you likely have some variable current valve solenoids on proportional pressure control valves. The operator's control levers signal these valves either directly or through an electronic control module. These valves have very small components inside and move only a tiny fraction of an inch. Contaminants will foul electronic proportional valves quickly and leave the machine out of service. If you have been filling your main reservoir with a pail and funnel, now is the time to consider a new method. Pumping fluid into the reservoir via a filtration system has become standard practice for many fleets.

2.Leaks and safety—If you see dripping or hydraulic fluid spraying from any hose, tube, fitting or component housing, do not touch any surfaces at or near that leak location. A fluid injection injury could be fatal or leave you disabled for life. Be sure to achieve a zero pressure state before any close inspection of a leaking component, or disassembly of any fluid line connection. Internal leaks can also develop. The operator won't be able to observe these directly. Unusual noises and temperatures are often the only clues.

3.Temperatures—Hydraulic oil temperature monitoring provides very useful clues to the state of a system. If the reservoir is topped up, and if cooling fans and radiators appear to be functioning normally, then higher temperatures are often correlated with internal leaks. At high pressures, a surprising amount of flow can pass through a fairly small orifice opening. Flow through this abnormal path will cause a heat build-up due to the friction of fluid molecules rubbing against the orifice surfaces

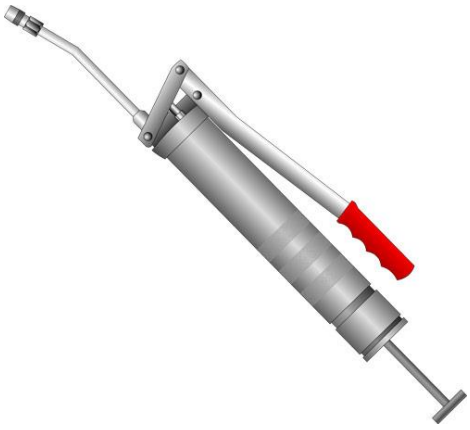
4.Pressures—For most large machines, and even for some small- and medium-sized machines with electrical/electronic operator joysticks, the first layer of hydraulic control is the pilot control system. A pilot system may even be present on machines that feature very little electrical and electronic control. These pilot systems are separate hydraulic circuits used to move large directional valve spools into position, or to shift a pump swash plate.

Fluid condition and cleanliness — Countless studies and papers clearly show how attention to the qualities and state of the hydraulic fluid is key to reliability and asset life, and how

Pump and hydraulic motor mounting — A tiny amount of free play and misalignment on the mounting of a pump can bring on severe damage. A missing bolt or a number of loose bolts can result in catastrophic failure when pump shaft splines grind and twist in the socket of the driving gear. Check pump mount bolts at the drive box or PTO for correct torque value. A simple visual observation that the bolts are not loose is not good enough. Similar issues apply for the hydraulic motor mounts.

Overall mechanical lubrication — Obviously a mobile machine has more systems to maintain than just the hydraulics. Gearbox lube and the greasing of swing gears and bearings, along with the pins where the cylinders mount and pivot can directly impact hydraulic system performance. Failing to grease can show up as a hydraulic cylinder slowdown or stall, and possibly an over-temperature

condition as well. If enough mechanical binding occurs, pressures may reach maximum values with minimum payloads on a lifting boom and a relief valve may crack open, dividing flow.



Gearbox lube and the greasing of swing gears and bearings, along with the pins where the cylinders mount and pivot can directly impact hydraulic system performance.

Brakes — Brake systems need to be reliable to the maximum degree. Many off-highway mobile machines such as loaders and graders utilize the main hydraulic system for braking functions. Often these machines are in transit on public highways. Whether they are on road or off, braking action is crucial to human safety. Most hydraulic brake systems consist of a gear or piston pump that flows through a check valve as it charges a small accumulator to a specific pressure. Once the correct pressure is reached, the brake pump is unloaded through a special valve. Obviously the accumulator precharge gas pressure will need to be checked periodically.

Information Sheet 5- Securing/tightening and maintaining bolts, nuts, guards and attachment couplings

5.1 Causes of Loose Bolts – and Ways to Prevent Them

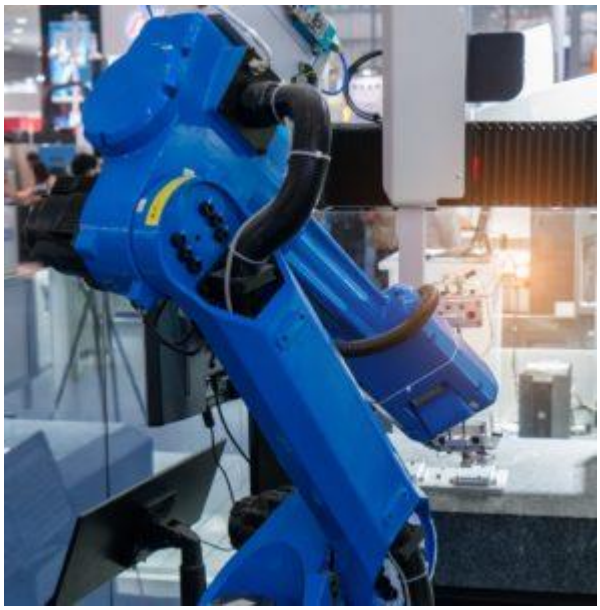
A pressurized bolted flange joint assembly begins to leak, creating a safety hazard. A rotor with its blades separates from the nacelle and spins off a wind turbine, crashing to the ground. Under constant vibration from the engine of an ocean freighter, loose bolts on a large piece of mining equipment work their way off the bolted joints and roll around the hull, inflicting further damage to the equipment.

Loose bolts are not just an irritating nuisance. If the joint is not quickly retightened, the application may begin to leak fluid or gas, the bolt may break, equipment may become damaged, or catastrophic accidents may occur.

There are at least five causes of loose bolts, which can occur separately or in combination:

Under-tightening. By definition, an under-tightened bolt is already loose and the joint does not have enough clamp force to hold the individual sections together. This can lead to sideways slippage between sections, placing unwanted shear stress on the bolt that could eventually cause it to break.

Vibration. Experiments on bolted joints under vibration show that many small "transverse" movements cause the two sections of the joint to move in parallel with each other and with the bolt head or nut. These repeated movements work against the friction between the bolt and joint threads that is holding the joint together. Eventually, vibration will cause the bolt to "unwind" from the mating threads and the joint to lose its clamp force.



Embedding. The design engineers who specify the tension on a bolt allow for a break-in period, during which bolt tightness relaxes to a certain degree. This relaxation is caused by micro-embedding of the bolt head and/or nut into the joint surface, and can occur with both soft materials, such as composites, as well as hard, polished metals. If the joint has not been designed properly, or if the specified tension was not achieved on the bolt at the start, this embedment of the joint can lead to a loss of clamp force.

Gasket creep. Many bolted joints include a thin, flexible gasket between the bolt head and the surface of the joint to seal the joint completely against gas or liquid leaks. The gasket itself acts as a spring, pushing back against the pressure of the bolt and the joint face. Over time, and especially near high heat or corrosive chemicals, the gasket may "creep," which means it loses its springiness, leading to loss of clamp force. This can also happen if the gasket area directly next the bolts is crushed, or if the bolts are not tightened evenly across the entire face of the joint.

Differential Thermal Expansion. If the material of the bolt and the joint are different, large differences in temperature due to rapid environmental changes or cycling industrial processes can cause bolt material to expand or contract rapidly, possibly loosening the bolt.

Shock. Dynamic or alternating loads from machinery, generators, wind turbines, etc., can cause mechanical shock – a sudden force applied to the bolt or the joint – causing the bolt threads to slip relative to the threads of the joint. Just as with vibration, this slippage can ultimately lead to loosening of the bolts.

Steps to Prevent Loose Bolts

Because loose bolts are so common, an astonishing array of devices has been invented to prevent them from occurring. Here are five basic types of prevention methods:

Washers. Washers are typically wider than the bolt head, with the additional surface area adding extra friction to the joint to maintain the clamp force. However, simple split washers, sometimes called helical spring washers, have been found to actually loosen the bolt under vibration even faster than a joint with no washer. Conical, or Belleville washers, are cup-shaped washers that perform little better than spring washers in vibration tests.

Several types of locking washers have been developed, with flutings, ribs or teeth that dig into the surface of the joint during the tightening process, in order to prevent loosening. This may cause permanent damage to the joint finish or surface, which may be unacceptable, such as in critical aerospace applications where surface indentations may cause fatigue stresses. It may also prevent re-tightening of the joint to the proper tension.

Wedge-locking washers work in sets of two, with each washer having opposite facing wedges that interact with each other and with the joint and nut surfaces to prevent self-turning of the bolt. The wedges are designed to add tension (stretch) to the bolted joint if the bolt begins turning due to vibration or shock, preventing a loss of clamp force.

Castellated nuts

Mechanical devices. Numerous clever gimmicks have been developed to lock a tightened nut into place on a bolted joint. Castellated nuts have a slotted end and are used with a cotter pin or wire that fits through a hole drilled in the bolt. Locking fastener systems have a shaped flat retainer, similar to a washer, and a clip that fits into a

groove on the bolt head. Tab washers have two tabs on opposite sides, which fold up to secure the bolt head or nut after installation, and may have teeth that can penetrate the surface of the joint to hold it in place. While these devices do prevent the nut from falling off the bolt, they generally do not help the joint maintain the specified clamp force.

Prevailing torque nuts. Nylon or metal inserts inside a nut (sometimes called a "lock nut") can add extra friction to prevent loosening. A related idea is to fit a spring inside the nut, which firmly grasps the bolt threads and is designed to move in the opposite direction of the nut if vibration or other forces cause it to unwind. Nylon inserts cannot be used in harsh chemical or high-heat applications, and typically can't be reused because the bolt threads cut grooves into the nylon, diminishing its ability to hold after re-tightening. Because the insert on most lock nut styles only covers part of the internal threads, a strong transverse motion or shock can still cause the bolt to self-loosen.

Double nuts. According to an article in Fastener + Fixing, the idea of using two nuts, a thick one and a thinner one (called a jammer nut), has been used for over 150 years to prevent loosening of bolted joints. A modern application is a system using two nuts each having different sized threads which advance at different rates on a dual-threaded bolt. In this way, transverse motions that may cause one nut to advance will not affect the second nut.

Adhesives. Liquid adhesives, as well as heated thermoplastic coatings or solid adhesive patches, have successfully been used to ensure bolts in certain applications do not come loose. The problem is that they make it harder to disassemble the joint later.

Maintaining Proper Tension Ensures Bolts Stay Tight

The combination of good bolted joint design, proper clamp force development, and suitable bolt retention devices can reliably secure a bolted joint against many of the challenges raised here.

A good bolted joint will be designed with the proper size and type of bolt and nut, and specify the optimal amount of tension to achieve the clamp force required to maintain joint integrity.

In the application itself, proper development of clamp force requires that the correct level of tension (preload) in each bolt has actually been achieved – and remains at that level throughout its operating lifetime.

Self-Check –	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1. how do you perform level check?

Does hydraulic system in small plants include air filtration?

(3pts)

Note: Satisfactory rating - 3 points Unsatisfactory - below 3 points

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Answer sheet

Test I

1._____

Information Sheet 5- Checking and adjusting function of controls and gauges

5.1.Control system

A control system manages, commands, directs, or regulates the behavior of other devices or systems using control loops. It can range from a single home heating controller using a thermostat controlling a domestic boiler to large Industrial control systems which are used for controlling processes or machines.

For continuously modulated control, a feedback controller is used to automatically control a process or operation. The control system compares the value or status of the process variable (PV) being controlled with the desired value or setpoint (SP), and applies the difference as a control signal to bring the process variable output of the plant to the same value as the setpoint.

5.2.Open-loop and closed-loop control

There are two common classes of control action:

open loop and

closed loop. In an open-loop control system, the control action from the controller is independent of the process variable. An example of this is a central heating boiler controlled only by a timer. The control action is the switching on or off of the boiler. The process variable is the building temperature.This controller operates the heating system for a constant time regardless of the temperature of the building.

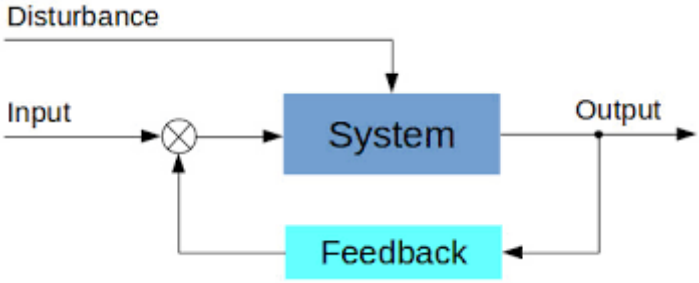
Example of a single industrial control loop; showing continuously modulated control of process flow.

In a closed-loop control system, the control action from the controller is dependent on the desired and actual process variable. In the case of the boiler analogy, this would utilise a thermostat to monitor the building temperature, and feed back a signal to ensure the controller output maintains the building temperature close to that set on the thermostat. A closed loop controller has a feedback loop which ensures the controller exerts a control action to control a process variable at the same value as the setpoint. For this reason, closed-loop controllers are also called feedback controllers.

5.3.Feedback control systems

in the case of linear feedback systems, a control loop including sensors, control algorithms, and actuators is arranged in an attempt to regulate a variable at a setpoint (SP). An everyday example is the cruise control on a road vehicle; where external influences such as hills would cause speed changes, and the driver has the ability to alter the desired set speed.

Control systems that include some sensing of the results they are trying to achieve are making use of feedback and can adapt to varying circumstances to some extent. Open-loop control systems do not make use of feedback, and run only in pre-arranged ways.



5.4.Logic control

Logic control systems for industrial and commercial machinery were historically implemented by interconnected electrical relaysand cam timers using ladder logic. Today, most such systems are constructed with microcontrollers or more specialized programmable logic controllers (PLCs). The notation of ladder logic is still in use as a programming method for PLCs.

Logic controllers may respond to switches and sensors, and can cause the machinery to start and stop various operations through the use of actuators. Logic controllers are used to sequence mechanical operations in many applications. Examples include elevators, washing machines and other systems with interrelated operations. An automatic sequential control system may trigger a series of mechanical actuators in the correct sequence to perform a task. For example, various electric and pneumatic transducers may fold and glue a cardboard box, fill it with product and then seal it in an automatic packaging machine.

5.5.On–off control

On–off control uses a feedback controller that switches abruptly between two states. A simple bi-metallic domestic thermostat can be described as an on-off controller. When the temperature in the room (PV) goes below the user setting (SP), the heater is switched on. Another example is a pressure switch on an air compressor. When the pressure (PV) drops below the setpoint (SP) the compressor is powered. Refrigerators and vacuum pumps contain similar mechanisms. Simple on–off control systems like these can be cheap and effective.

5.6.Gauge (instrument)

A gauge or gage, in science and engineering, is a device used to make measurements or in order to display certain dimensional information. A wide variety of tools exist which serve such functions, ranging from simple pieces of material against which sizes can be measured to complex pieces of machinery. Depending on usage, a gauge can be described as "a device for measuring a physical quantity", for example "to determine thickness, gap in space, diameter of materials, or pressure of flow", or "a device that displays the measurement of a monitored system by the use of a needle or pointer that moves along a calibrated scale".

5.7.Basic types of Gagues

All gauges can be divided into four main types, independent of their actual use.

Analogue instrument meter with *analogue display* ("needles"). Until the later decades the most common basic type.

Digital instrument meter with *analogue display*. A screen that shows an "analogue meter", commonly used in modern aircraft cockpits, and some hospital equipment etc.

Digital instrument meter with *digital display*. Only numbers are shown at a digital display.

Analogue instrument meter with *digital display*. Only numbers are displayed, but through a mechanical or electro-mechanical display (today very rare but has existed for clocks, certain Doppler meters and informational screens at all kinds of stations and airports)

The two first basic types are usually easier for the human eyes and brain to interpret, especially if many instrument meters must be read simultaneously. The other two types are only displaying digits, which are more complex for humans to read and interpret.

5.8 Checking and adjusting

Measurement device

To stop any unwanted variation in a production process, a control loop monitors the process regularly to check it's performing as it should. This is usually done by a sensor that measures a particular property like temperature. A transmitter converts the sensor's output into a signal which is sent to a controller. The signal can be sent individually or with other signals through a special network - called a 'fieldbus'.

The controller

The controller compares the measurement recorded by the sensor against the pre-set value. If there's an unacceptable difference it initiates appropriate action. For example, if an oven's temperature has fallen too far, it instructs the regulator to send more fuel to the burners to increase it up to the required set-point.

Most of the control tasks required by an industrial process can be handled by a well-designed and well-tuned **single-loop controller**. These normally monitor a single measurement and adjust one regulator, but they can also be linked to another controller to adjust another related set-point. This is known as a 'cascade system'.

The regulator

The regulator controls the throughput of the process. It responds to commands from the controller and makes adjustments where necessary. Control valves are the most common type of regulator - these adjust the flow of a fluid in response to messages from the controller. A variable speed pump is an alternative type of regulator which controls the flow of a fluid more accurately and with greater

energy efficiency. Variable speed drives can also be used where the controller regulates the movement of solid materials rather than fluids or gases.

Self-Check – 5	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1. Describer close loop control system?

(3pts)

Note: Satisfactory rating - 3 points Unsatisfactory - below 3 points

Score = _____

Rating: _____

You can ask you teacher for the copy of the correct answers.

Answer sheet

Test I

1._____

Information Sheet 6- Applying operator's manual to start-up and shutdown gauges

The operations manual is the documentation by which an organisation provides guidance for members and employees to perform their functions correctly and reasonably efficiently. It documents the approved standard procedures for performing operations safely to produce goods and provide services. Compliance with the operations manual will generally be considered as activity approved by the persons legally responsible for the organisation.

The operations manual is intended to remind employees them of how to do their job. The manual is either a book or folder of printed documents containing the standard operating procedures, a

description of the organisational hierarchy, contact details for key personnel and emergency procedures. It does not substitute for training, but should be sufficient to allow a trained and competent person to adapt to the organisation's specific procedures.

The operations manual helps the members of the organisation to reliably and efficiently carry out their tasks with consistent results. A good manual will reduce human error and inform everyone precisely what they need to do, who they are responsible to and who they are responsible for. It is a knowledge base for the organisation, and should be available for reference whenever needed. The operations manual is a document that should be periodically reviewed and updated whenever appropriate to ensure that it remains current.

Motor graders are sophisticated machines equipped to handle tough conditions, but they need to be operated properly and optimally. Beginner users, and even experienced operators, should take note of the proper procedures for operating them.

To begin, how should you start and shut down the machine? Here's a basic guide.

Starting up your motor grader

Step1:Make sure all your pre-start procedures have been followed. These include checking for any defects or potential problems while you grease the machine.

Step2:Do any parts seem worn or broken? Are there any leaks?

Step3:Check the fuel, coolant and oil levels; the power-steering reservoir and power-shift transmissions.

Step4: Make sure you've done all the checks suggested in the Operator's manual. Then you're ready to start.

In neutral and with the parking brake on, open the throttle to a quarter and turn the starter. Depress the clutch to ease the starter load, and don't press on the starter for more than 30 seconds. If you do, you may need to wait a couple minutes before using the starter again.

Once the motor has started, idle for a few minutes as you check the gauges. Are all of them operating? Then check the controls, giving the hydraulic oil some time to warm up.

Shutting down the motor grader

When it comes time to shut down the machine,

Step1:give it a few minutes to cool down. Two to three minutes should do it.

Step2: Make sure you park the machine as near to level as possible,

Step3: lower all hydraulic equipment to the ground and set the parking brake.

Once the machine is off, walk around the machine looking for any leaks (such as leaks in the hydraulic system hose or connections; fuel, coolant, grease or oil leaks) or loose, worn parts.

Finally, use the following checklist as part of your post-shutdown quality

Step4:check for blade wear and tear (they should be wearing straight, not cupped in the middle)

Step5:check the levels of the oil, coolant, fuel

Step6:heck for any dirt or mix that should be cleaned to prevent hindrances to the sliding surface, lubrication point or pivot setting.

Operation Sheet 1	CONTENT- pre- operation check

Steps		Conditions to check	Remark
1	Mechanical	Running Hours (check the hourly guage and enter amount)	
2		Clean generator for good condition Clean shed for good condition	
3		Fuel tank at least 50% full Fuel leaks? Fuel cap on?	
4		Motor Oil level is okay Motor Oil condition	
5		Radiator, no leaks Radiator coolant level okay?	
6		Battery connections good?	

		Battery water level ok? Battery Charger is charging?	
7		No Leaks (look underneath generator)	
8		Exhaust system is functioning normally?	
9		Auto-start is working?	
10		All Tools and equipment are present and in good condition?	
11		Water decanter (does it need to be drained?)	
12	safety	Fire extinguisher present Fire extinguisher working First Aid Kit present? First Aid Kit complete?	
13	Document	Generator Log present? Daily Check forms present? Manuals present?	

LG #52	LO #3- Use small plant and equipment

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Applying safety plan
- Identifying site hazards and establish controls
- Identifying and applying operating techniques
- Operating machines within design specifications
- Locating plant and equipment safely
- Interpret and apply information

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Apply safety plan
- Identify site hazards and establish controls
- Identify and applying operating techniques
- Operate machines within design specifications
- Locate plant and equipment safely
- Interpret and apply information

Learning Instructions:

Read the specific objectives of this Learning Guide.

1) Follow the instructions described below.
2) Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
3) Accomplish the “Self-checks” which are placed following all information sheets.
4) Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
5) If you earned a satisfactory evaluation proceed to “Operation sheets
6) Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
7) If your performance is satisfactory proceed to the next learning guide,
8) If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information Sheet-1	Applying safety plan

1.1.OPERATIONAL SAFETY PLAN

The POS (Operational Safety Plan, OSP) is the document that the employer of the company carrying out the work prepares to operate on construction sites in accordance with the current regulations regarding occupational safety

General Requirements

Machine guarding will be provided to protect the operator and other employees in the machine area from injury as a result of coming in contact with moving parts in the mechanical motions of the machines.

- **Hand Tools**

✓ Use the correct tool for the task at hand.
✓ Keep landscaping tools in good condition.
✓ Use tools in the manner they are intended to be used.
✓ Store tools in a safe place.
✓ A safe cutting tool is one that is sharp and clean.
✓ Tool handles should be smooth and strong.

Shovels, spades, and other digging tools should have parts that are smooth and properly shaped.

Electric Landscaping Tools

Read the operator's manual carefully before switching on the tool.

- If a tool is equipped with a three-hole grounded receptacle, a three-wire extension cord should be used.

✓ Never use electrical power tools in the rain or when grass or shrubs are wet.
✓ Do not abuse the flexible electric cord.
✓ The cord should be draped over the shoulder while the tool is in operation.
✓ Never carry a tool by the receptacle.
✓ Always us a cord heavy enough to carry proper current.
✓ Be sure to avoid cutting the cord with the tool or equipment.
✓ Hand and Portable Powered Tools and Other Hand-Held Equipment

General requirements:

All hand and portable powered tools and equipment will be maintained in a safe condition free of worn or defective parts.

Point of operations guards:

All portable powered tools capable of receiving guards and/or are designed to accommodate guards will be equipped with such guards so as to prevent the operator from having any part of his/her body in the danger zone during the operating cycle.

Power cut-off and pressure control devices:

a) **Electric tools (general)** -- Portable electric tools which are held in the hand shall be equipped with switches of a type which must be manually held in closed position.

b) **Gasoline Powered Equipment** - Gasoline is made for one purpose--to create an explosion, thereby releasing energy for power. When used improperly, gasoline can cause death and destruction.

The following points should be followed when handling gasoline:

1) Never use gasoline for cleaning floors, tools, cloths or hands. Gasoline is only to be used in engines as a source of energy.

2) Always store gasoline in an approved closed container. Never use an open container, glass or other breakable container.

3) Pouring gasoline from one container to another may generate a charge of static electricity.

4) Gasoline spills should be cleaned up immediately to prevent accumulation of vapors.

6)Gasoline tanks or equipment parts that are likely to contain gasoline should be drained or dismantled only out of doors or in a well ventilated area free from sources of ignition.

7) Never smoke in fueling areas, fuel system servicing areas, maintenance areas, bulk fuel delivery areas or similar locations.

8) Never dispense gasoline into the fuel tank while the engine is running or if the motor is hot.

9) Never store equipment with fuel in the tank inside a building where vapors could reach an open flame or spark.

Self-Check – 1	**Written test**

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1. what are the most popular safety analysis methods(3pts)

Note: Satisfactory rating - 3 points Unsatisfactory - below 3 points

Score = _____

Rating: _____

You can ask you teacher for the copy of the correct answers.

Answer sheet

Test I

1._____

Information Sheet 2- Identifying site hazards and establish controls

2.1.Hazards

There are many definitions for hazard but the most common definition when talking about workplace health and safety "A hazard is any source of potential damage, harm or adverse health effects on something or someone."

Laboratory hazards include not only chemical and biological hazards but physical hazards as well. These include, but are not limited to, slips, trips, and falls, sharps, compressed gases, pressurized equipment, electrical equipment, lasers, radiation, mechanical hazards, noise, and thermal hazards

"Occupational health and safety - Hazard identification and elimination and risk assessment and control" uses the following terms:

Harm – physical injury or damage to health.

Hazard – a potential source of harm to a worker.

Basically, a hazard is the potential for harm or an adverse effect (for example, to people as health effects, to organizations as property or equipment losses, or to the environment).

Hazard identification

Hazard identification is part of the process used to evaluate if any particular situation, item, thing, etc. may have the potential to cause harm.

Identify hazards and risk factors that have the potential to cause harm (hazard identification).

Analyze and evaluate the risk associated with that hazard (risk analysis, and risk evaluation).

Determine appropriate ways to eliminate the hazard, or control the risk when the hazard cannot be eliminated (risk control).

Overall, the goal of hazard identification is to find and record possible hazards that may be present in laboratory area. It may help to work as a team and include both people familiar with the work area, as well as people who are not – this way you have both the experienced and fresh eye to conduct the inspection.

- **Hazard identification can be done:**

✓ During design and implementation
✓ Before tasks are done
✓ While tasks are being done
✓ During inspections
✓ After incidents

A common way to classify hazards is by category:

chemical – depends on the physical, chemical and toxic properties of the chemical,

Ergonomic – repetitive movements, improper set up of workstation, etc.,

physical – radiation, magnetic fields, temperature extremes, pressure extremes (high pressure or vacuum), noise, etc.,

psychosocial – stress, violence, etc.,

safety – slipping/tripping hazards, inappropriate machine guarding, equipment malfunctions or breakdowns.

To be sure that all hazards are found:

Look at all aspects of the work and include non-routine activities such as maintenance, repair, or cleaning.

- ✓ Look at the physical work environment, equipment, materials, products, etc. that are used.
- ✓ Include how the tasks are done.
- ✓ Look at injury and incident records.
- ✓ Talk to the workers: they know their job and its hazards best.
- ✓ Include all shifts, and people who work off site either at home, on other job sites, drivers, teleworkers, with clients, etc.
- ✓ Look at the way the work is organized or done (include experience of people doing the work, systems being used, etc).
- ✓ Look at foreseeable unusual conditions (for example: possible impact on hazard control procedures that may be unavailable in an emergency situation, power outage, etc.).
- ✓ Determine whether a product, machine or equipment can be intentionally or unintentionally changed (e.g., a safety guard that could be removed).

Self-Check – 2	**Written test**

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

1.how can we identify hazards in work environment?

Note: **Satisfactory rating - 6 points** **Unsatisfactory - below 6 points**

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Test I

1. _____

Information Sheet 3- Operating machines within design specifications

3.1. Specification

A specification often refers to a set of documented requirements to be satisfied by a material, design, product, or service. A specification is often a type of technical standard.

There are different types of technical and the term is used differently in different technical contexts. They often refer to particular documents, and/or particular information within them. The word specification is broadly defined as "to state explicitly or in detail" or "to be specific".

Using the term "specification" without a clear indication of what kind is confusing and considered bad practice.

A requirement specification is a documented requirement, or set of documented requirements, to be satisfied by a given material, design, product, service, etc.

A design or product specification describes the features of the solutions for the Requirement Specification, referring to either a designed solution or final produced solution. It is often used to guide fabrication/production.

An "in-service" or "maintained as" specification, specifies the conditions of a system or object after years of operation, including the effects of wear and maintenance (configuration changes).

Specifications are a type of technical standard that may be developed by any of various kinds of organizations, both public and private. Example organization types include a corporation, regulatory agencies, and national laboratories and institutes).

Self-Check – 3	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

What is specification?()

Note: Satisfactory rating - 3 points **Unsatisfactory - below 3points**

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Test I

_____

Information Sheet-4	Locating plant and equipment safely

4.1. Concept of Plant Layout:

Plant layout is a plan for effective utilisation of facilities for the manufacture of products; involving a most efficient and economical arrangement of machines, materials, personnel, storage space and all supporting services, within available floor space.

Objectives/Advantages of Plant Layout:

(i) Streamline flow of materials through the plant

(ii) Minimise material handling

(iii) Facilitate manufacturing progress by maintaining balance in the processes

(iv) Maintain flexibility of arrangements and of operation

(v) Maintaining high turnover of in-process inventory

(vi) Effective utilisation of men, equipment and space

(vii) Increase employee morale

(viii) Minimise interference (i.e. interruption) from machines

(ix) Reduce hazards affecting employees

(x) Hold down investment (i.e. keep investment at a lower level) in equipment.

Plant Layout in Operation Management

Plant layout refers to the physical arrangement of production facilities. It is the configuration of departments, work centers and equipment in the conversion process. It is a floor plan of the physical facilities, which are used in production.

The primary goal of the plant layout is to maximize the profit by arrangement of all the plant facilities to the best advantage of total manufacturing of the product.

A materials location system having an information storage device storing materials storage location information, location coordinates of stocked materials control object, and design information of materials control object and a materials location control device having a computing device, said materials location system comprising: a materials location control device having means for calculating locations of the materials control objects stocked at the materials storage location and area and coordinates of areas where the materials control objects are not placed, from the storage location information, the location coordinates of stocked materials control object, and the design information from which dimensions and shapes of the materials control objects can be recognized.

Generally, locating plant and equipment safely, means, keeping a facility's stairways slip-resistant and free of debris, or having audible warning systems for hazardous protection.

Self-Check – 4	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

1. what is plant layout

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Name: _____ Date: _____

Test I

1. _____

Information Sheet-5	Interpret and apply information

5.1.Collecting Information in the Workplace

5.1.1. Inspections

Regular inspections are a great way to spot problems. Use your eyes, ears and nose as you walk through the job site or Laboratory area. Note whether the air feels too hot or cold. Record the hazards you find such as labels on chemical containers, dangerous machinery, wet floors, attacks from inmates or clients, lifting, contact with blood or body fluids, and so on.

Talk to your co-workers as you go through the workplace. They will know about problems that you may not be able to spot. Your co-workers can tell you if working conditions have changed over time. They can also let you know if there have been any close calls where someone almost got hurt.

Keep notes on where you find hazards. Note the names of people who give you information. It is also a good idea to draw a floor plan of the area.

If you have a checklist as you go through the Laboratory area you will not have to remember everything you are looking for. You can use the checklist to go back later to see if problems have been corrected.

Surveys

Surveys can be useful to find out what problems concern members and what they are willing to do about them. They can be done in the form of a written questionnaire or in person. Keep these points in mind when using a written survey:

Keep it as short as possible.

Use words that everyone will understand.

Ask questions that can be answered yes or no, true or false, multiple choice, or with a check mark.

Leave space for workers to write additional information and opinions.

It is often more effective to do a survey by asking workers questions and writing down their responses. The benefits of a one-on-one survey are that:

They are a good technique for organizing as they get people talking about their jobs.

It is a way to involve workers who do not read well without embarrassing them.

You will often get a better response than by sending out paper that may get lost or ignored.

Besides finding out what workers are concerned about, ask if they would be willing to put some time and energy into solving a problem. If no one is concerned enough

about a problem to do anything about it, this may not be a good issue to start working on.

Workplace communication is the process of exchanging information and ideas, both verbal and non-verbal, within an organization.

Improving safety

Mining Laboratoy is an inherently dangerous business and communications play a key role in improving the safety of individuals and increasing operational efficiency. Technology has enabled active surveillance and remote monitoring. It has even helped to provide better medical response following major incidents.

Self-Check – 3	**Written test**

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

what a communication tools in workplace??

Note: Satisfactory rating - 3 points **Unsatisfactory - below 3points**

You can ask you teacher for the copy of the correct answers.

Score = _____
Rating: _____

Answer Sheet

Name: _____ Date: _____

Test

Operation Sheet 1– pre operation check of oil level

How to Check Your Car's or Generator Oil Step-by-Step

Step 1: Turn Off the machine

First thing's first, make sure your vehicle engine is off and that it's been sitting for while on level ground. You want the engine to be cool, not hot like it had just been running. Go ahead and pop the hood!

Step 2: Find the Oil Dipstick

Next, you'll want to find the oil dipstick. Your dipstick usually has an orange or yellow top and sticks out near the engine. There should be a loop that you can grab onto, but there might not be. All cars are different, so you might have to consult your owner's manual if you are having trouble finding it.

Step 3: Pull Out the Dipstick

Grab the oil dipstick, pull it out, and wipe the end with a lint-free rag or a paper towel. When the dipstick is clean, dip it fully back into the pipe and pull it out again.

Step 4: Assess t he Level

When you pull the dipstick back out, take a look at the bottom and see where on the stick the oil covers. There are two small fluid level lines marked on your oil dipstick letting you know where the minimum and maximum oil level should reach. There should be motor oil covering the dipstick up to the maximum mark.

Step 5: Adjust Oil Levels if Needed

If the level is good, shove that puppy back into the pipe and call it a day. If not, you might have to add oil to the engine. To do this, remove the oil cap and carefully pour in the correct amount until the oil level reaches the line marked on your dipstick. Check out your vehicle's owner manual for info on where the oil goes, what kind you need (synthetic oil, 5W-30, 10W-40, etc.), and how much you should add. These ratios can vary depending on a number of factors like if you have a diesel engine or if you use synthetic oil.

If the tank requires a whole quart of oil to get it to the right level, it's way too low and you should probably check in with a mechanic so they can make sure you don't have an oil leak.

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 1 hour .

Task 1.

Task 2.

LG #53	LO #4- Carry out operator maintenance

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Applying organizational maintenance requirements
- Preparing plant/equipment shutdown
- Conducting inspection and fault finding
- Removing and replacing defective parts
- Carrying out regular programmed maintenance

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Apply organizational maintenance requirements
- Prepare plant/equipment shutdown
- Conduct inspection and fault finding
- Remove and replace defective parts
- Carry out regular programmed maintenance

Learning Instructions:
Read the specific objectives of this Learning Guide. Follow the instructions described below 3 to 6. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3, and Sheet 4” and sheet 5. Accomplish the “Self-check 1, and Self-check 2” in page 9, and 10respectively. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, and Operation Sheet 2” in page 11 and 12 respectively. Do the “LAP test” in page – 13 (if you are ready).

Information Sheet-1	Applying organizational maintenance requirements

Maintanance

Maintanance is the responsibility of and performed by a using organization on its assigned equipment. Its phases normally consist of inspecting, servicing, lubricating, and adjusting, as well as the replacing of parts, minor assemblies, and subassemblies.

During Appling Maintance Cosider the followwing

Promoting versatility.

The versatility and tactical optimization

The versatility of a maintenance engineer is the antithesis of specialization. This means the possibility that an operator can intervene in maintenance tasks related to various kinds of maintenance. The overall versatility mean that an operator could intervene in maintenance repairs of any kind within the company.

Promoting versatility overcomes the disadvantages found in the specialization: reducing the number of people necessary (more people trained to a greater number of tasks), increases performance, and allows to decrease the number of human resources in the maintenance department.

Economic performance versatility are so favorable that today any company who wants to reduce their costs (ie, almost all companies) must planteársela as a means to achieve this goal.

One question that arises when we try to raise as versatility is making the transition from a situation where specialization towards maintenance workers to perform multiple functions. The steps we must take are:

Identify unique tasks. Exclusive tasks are those that perform only a very small number of operators

Identify tasks that can be performed by other specialties. Not all tasks can be performed by any operator (some need high training and a long period of training to be developed effectively), but many can be performed by any operator with a minimum training period. It is for certain measurements, the disconnection of an engine or welding underperforming.

Develop a training plan that includes training in performing tasks that are considered unique and tasks that are considered likely to generalize.

Perform this training plan. Of course, we must not only stay in the design phase of the plan, but must establish resources and time needed to do, to plan and carry it out

Compose work procedures and technical instructions. If all activities were properly performed procedimentadas department with instructions and procedures clear and understandable by any operator (sometimes called guide-donkeys), exclusivity, and the indispensability specialization would not be a problem. The wording of these documents ensures that any operator at all times have the information necessary to perform any task.

Primar economically versatility. Reverting to the operators themselves a part of the savings for the company to have different skills, motivate staff is achieved to opt for the non-specialist. It is important to have any effect, must be on the payroll as an additional plus for versatility, instead of increasing the bulk primary wage

Create categories based on versatility. Certain companies that have opted for versatility have made a difference between staff trained in various specialties and expertise. The highest category corresponds to different skills. This category can be increased or no economic impact.

Select the new staff be provided versatile. To implement this form of promotion of non-specialization, it is only necessary that new staff be required between the terms of engagement have knowledge and / or experience in various specialties.

Self-Check – 1	**Written test**

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I Choose the correct answer for the following question

1. what is the advantage of specialization in maintenance ? (3)

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Test I

1. _____

Information Sheet-2	Preparing plant/equipment shutdown

2.1.To Prepare for Plant Shutdown

Make a Plan: Utilize tools available to you to outline a thorough plan of what needs to be accomplished **during or before** the plant shutdown, such as a scheduling software or even a spreadsheet.

Prioritize time critical activities with a list.

Use past documentation/experiences to help you apply a duration for each repair. Analyze where/why overruns occurred and what you can do to avoid them this time.

These are the systems and equipment that need to be serviced in order for your plant to run efficiently until your next shutdown:

The equipment/system needing service.

The scope of work for the repairs/maintenance.

Its priority rank, 1 being most crucial and 100 being the least.

Include the trades needing access to the equipment/system. Can they work at the same time? What order will they need access?

Do you have a lockout plan? Who locks this equipment out?

Prioritize access.

Consider a pre-shutdown coordination meeting or call including all lab-technicials working on critical equipment.

Use this as a guideline to create your shutdown schedule. Have contingency plans ready to go if issues are found upon inspection. Have your list of lower priority items for lab-technicials that complete scope ahead of schedule. If you brought in the materials ahead of time, some items that didn't make the cut may still be completed.

Provide a schedule of work ahead of time.

List the equipment, the duration and theLab-technicial's priority.

As you know, there is a lot of planning involved and you might have missed something. To save time with debates that can happen on site, release these ahead of time so everyone can have their questions answered.

Have a map of your site:

- ✓ List parking areas.
- ✓ Cell phone areas.
- ✓ Technicial staging areas.
- ✓ Exit plans.

Organize Your Team: During a plant shutdown, roles often change. Maintenance professionals are often shifted to new areas of the plant or someone could be placed in charge of temporary lab-Technicial.

Prepare Your Equipment: Shutdown is a time for maintenance and preventative maintenance – this means testing, troubleshooting, and repair! Be sure that you have the right tools available to get the job done, before and during shutdown.

Meet Regularly: Before shutdown begins, meet with your team to make sure that every employee is aware of what they will be doing over the next week or so. Meetings are recommended to touch base every single day, even more than once, to ensure that each task is completed.

Document Everything: "The best inspection in the world will do you no good if you can't prove it." (Hy-Lok). Make sure to dot the i's and cross the t's on all formal documents and be open to process improvement measures. You will thank your team come time for the next shutdown!

Expect a Surprise: With any plan, something is bound to go wrong. A task might take longer than anticipated to complete, or additional work could present itself. These are things that can be

avoided, but not entirely. Overcompensate for available staff and get all hands-on deck while there is still time.

Self-Check – 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I short answer

1 . How can we plan a plant shutdown?

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Test I

1. _____

Information Sheet-3	Conducting inspection and fault finding

3.1.Overview and Basic Terminology

A “fault” is another word for a problem. A “root cause” fault is a fundamental, underlying problem that may lead to other problems and observable symptoms. (It might not be directly observable). A root cause is also generally associated with procedures for repair.

A "fault" or "problem does not have to be the result of a complete failure of a piece of equipment, or even involve specific hardware. For instance, a problem might be defined as non-optimal operation or off-spec product. A fault may be considered a binary variable (”OK” vs. “failed”), or there may be a numerical “extent”, such as the amount of a leak or a measure of inefficiency.

A symptom is an observed event or variable value, needed to detect and isolate faults. If a symptom is the response to a question or an on-demand data request (when actively testing a system instead of just passively monitoring it), it is referred to as a test or test result.

Fault detection is recognizing that a problem has occurred, even if you don't yet know the root cause. Faults may be detected by a variety of quantitative or qualitative means. Fault diagnosis is pinpointing one or more root causes of problems, to the point where corrective action can be taken. This is also referred to as “fault isolation”, especially when emphasizing the distinction from fault detection. In common, casual usage, "fault diagnosis" often includes fault detection, so “fault isolation” emphasizes the distinction.

Knowledge and understandingYou need to know and understand:

- ✓ you must have a working knowledge and understanding of what yourresponsibilities are in respect of Health, Safety and Environment. Thisshould include the limits of your personal responsibility, your legalresponsibility for your own health and safety and the health and safety ofothers
- ✓ you must have a working knowledge of the relevant regulations and thesafe working practices and procedures required within your work area
- ✓ you must have a working knowledge and understanding of faultdiagnostic aids. This could be expected to include mechanical testequipment, historical data and schematic drawing

- ✓ you must have a working knowledge and understanding of fault findingmethods and techniques this should include how to investigate problems,how to identify the extent and location of problems and what to do whencauses are difficult to find, and which actions can be taken to deal withthe fault
- ✓ you must have a working knowledge and understanding of analysis method and techniques. This could be expected to include historical data, comparison, and circuit measurements
- ✓ you must have a working knowledge and understanding of companyprocedures and manufacturers guidelines for the operating and care oftest equipment and control procedures
- ✓ you must have a working knowledge and understanding of assessing thelikely risks arising from faults such as fire, electric shock and damage toplant
- ✓ you must have a working knowledge and understanding of maintenance reporting documentation and control procedures and how descriptionsshould be presented, why it is important to record results of thediagnosis, and why it is important to relay conclusions on to others in atime span appropriate to the nature of the problem
- ✓ you must have a working knowledge and understanding of your responsibilities with regard to the reporting lines and procedures in your working environment

Scope/range related to knowledge and understanding

The Knowledge and Understanding levels expressed indicate the minimumlevel of knowledge and understanding sufficient to perform your role in amanner that would normally be associated with the minimum acceptableperformance of a competent person undertaking your role.

The expression ”working knowledge and understanding” indicates you areable to:

Identify and apply relevant information, procedures and practices toyour usual role in your expected working environments needing onlyoccasional recourse to reference materials

Describe, in your own words, the principles underlying your workingmethods. This does not mean the ability to quote “Chapter and verse”.Rather you must know what supporting information is available, howand where to find it and from whom to seek further guidance andinformation confirm any additional required detail

Interpret and apply the information obtained to your role, your working practice and in your expected working environment

Self-Check – 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I short answer

1. why is inspection so important? (3)

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Test I

1. _____

Information Sheet-4	Removing and replacing defective parts

4.1 Replacing

When equipment breaks down, everything from your productivity to your bottom line is disrupted. Your team needs a quick and effective solution.

Replacing equipment is the larger investment, so many technicians choose to repair the equipment instead of replacing it. But the costs that go along with frequent breakdowns — lower productivity, defective output, rising labor costs, and unmet production schedules — can sometimes be greater than the cost of replacing the equipment outright.

Leaving your decisions to guesswork can be a costly and dangerous approach. If you aren't using a computerized maintenance management system (CMMS) effectively, you'll be forced to make decisions reactively, and as soon as something breaks down, you'll need to make a quick decision on what to do. With productivity plummeting, your decision will likely be made from an emotional standpoint, rather than solid data to support your decision.

Data Driven Decisions

Without a plan in place, your only concern will be getting your production back online as quickly as possible. The reactive decision you're forced to make may work out, but you may also end up making a hasty decision that solves the problem in the short-term but isn't the best solution in the long run.

In addition to the obvious replacement cost for a new piece of equipment, there are several other factors to take into consideration when deciding whether to repair or replace a piece of equipment:

Ongoing maintenance costs over the remaining life of the equipment

The impact any repair would have on productivity and quality

Costs incurred from the equipment downtime

Health, safety, and environmental costs that come with equipment breakdown

Training costs for a new piece of equipment

Disposal costs

Installation costs

With so many factors to consider, it's clear this decision shouldn't be made without the proper data analysis.

1. Analyze the Costs

Always think in the long-term when analyzing the costs of repairing or replacing. For a new piece of equipment, consider the cost of purchasing the equipment, its service life, potential salvage value, operating costs, and any revenue increase it may bring.

For an old piece of equipment, consider its remaining service life, operating costs, its market value and future salvage rate. From these figures, you can determine an annual average cost for each option, which will then be easy to compare.

2. Consider the Age of Equipment

Equipment does not age with grace. The older your machinery, the more extensive repairs it will need. This often translates to higher maintenance costs. As you continue to repair, the machine will give you less and less for your investment of repair. You may want to consider replacing an old malfunctioning piece of equipment for a newer, technologically advanced model that will give you better efficiency and longevity. When your equipment is new, it makes more sense, in many cases, to repair it once it malfunctions.

3. Consider the Cost of Repairs

What are the cost of repairs, and more importantly, how often will you be paying those costs for repairs? Documenting asset repair events provides information on number and frequency of breakdown events and costs for the repairs. Can you tell if you're going to continue repairing this equipment several times a year, or will it likely just be a one-time fix?

4. Consider Downtime

What's the impact of downtime while the asset is being repaired? If it takes several days to repair, and if this happens frequently, you're looking at too many hours of lost productivity. Consider this when deciding if repair or replacement is better in your situation.

Keep in mind, however, that repairing often takes less time than replacing a machine. Replacing involves waiting for the replacement to arrive, installation, new training, and more. If you're on an extremely tight schedule and if the equipment is crucial to your process, you may lose too much in production if you take the time to replace.

5. Consider Safety

Remember that older equipment can cause injury to workers if it malfunctions. Even if you stay up to date on maintenance, equipment wears down as it ages. Thoroughly inspect your machinery before making your decision so you can determine if your current equipment will continue to provide a safe environment for your workers. If it won't, replacement is the obvious choice. If it is still meeting safety standards, it's worth comparing costs of a replacement versus repair.

6. Consider Efficiency

Always think of the long run. How efficient is your machine operating now, and will a simple repair keep efficiency at the level you want, or would a new piece of equipment that uses less fuel, offers newer features, and breaks down less frequently be better for your efficiency and your bottom line?

Self-Check – 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I short answer

1. why do we need to replace a machinery? And what procedures to follow? (3)

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Test I

1. _____

Information Sheet-5	Carrying out regular programmed maintenance

5.1. PROGRAM MAINTENANCE (PM)

PM is a maintenance process where the condition of the equipment is monitored for early signs of impending failure. Advanced technologies are used in order to determine equipment condition. The advanced technologies include the following,

Oil Analysis programs- Particle count, Spectrochemical analysis, filtergram

Pump and motor performance testing

Vibration Analysis and Measurement

Thermo / inspections

Graphing cycles in pressure and flow

In addition

Preventative Maintenance Inspections

Magnetic Plug Inspections

Filter Analysis

System Reviews and redesigns

5.2.Purpose of program maintenance

Steps to operational excellence:- In order to achieve your goals, we must firstly address your needs. Which are:

- Predict equipment failures
- View the overall condition of the equipment
- Greater accuracy in failure prediction
- Reduce the cost of condition monitoring
- Improve equipment and component reliability
- Optimise equipment performance

Preventive Maintenance Objectives:

Reduce major repairs by correcting minor difficulties as soon as they are evident. This means listening to your operators who usually recognise before management that machinery is making a “funny noise” or other irregularity in performance of equipment. Do not punish employees who are trying to report a defect beyond their control.

Maintain equipment in a more productive state. Keep it clean; repair or replace lost or worn parts immediately. Follow the machinery manual recommendations.

Improve scheduling of repairs. Do not postpone needed repairs. Delaying repairs usually results in much more costly problems later on.

Maintain safety. Some parts as they become worn become dangerous, as in worn chain or belt drives. Staff are valuable and injuries are costly from the standpoint of lost time and training replacements, not to mention adverse impacts on employee morale.

Improved customer service. A well-maintained mill looks good to the customer and helps assure the customer that the feed is made correctly the first time.

Reduce overall operating costs. The miller of aquaculture feeds benefits from a well-maintained facility through reduced costs of operation and customer satisfaction.

Provide trained maintenance personnel. Training of maintenance staff should be a high priority with high-level management oversight. Too often maintenance is seen as the bottom of the ladder, when in reality the quality and training of staff for this important responsibility should be paramount.

By applying our technology as outlined above, we have helped you to achieve the following benefits:

- ✓ Fewer breakdowns
- ✓ Greater productivity
- ✓ Reduced costs
- ✓ Optimise oil change periods
- ✓ Extend equipment life
- ✓ Greater equipment performance

Self-Check – 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I short answer

1. What will we consider in maintenance planing? (3)

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Test I

1. _____

Operation sheet-1	compressor operator maintenance

Method of compressor operator maintenance

Step 1- Check compressor lubricant level in crankcase and cylinder lubricator and, if necessary, add to level indicated by sight gauge.

Step 2- Check cylinder lubrication feed rate and adjust, as necessary.

Step 3- Check lubricant pressure and adjust as necessary to meet specified operating pressure.

Step 4- Check cylinder jacket cooling water temperatures.

Step 5- Check capacity control operation. Observe discharge pressure gauge for proper LOAD/UNLOAD pressures.

Step 6- Drain control line strainer.

Step 7- Check operation of automatic condensate drain trap (intercooler and aftercooler).

Step 8- Drain condensate from discharge piping as applicable (dropleg and receiver).

Step 9-Check intercooler pressure on multi-stage machines, and refer to manufacturer's manual if pressure is not as specified.

Operation sheet-2	**Generator Layup**

Procedures for Generator **Layup**

When an emergency generator is removed from service for a permeate period of time it is placed in the layup status. Some basic steps to place a generator in layup can include:

Step 1. Disconnect generator batteries.

Step 2. Drain fuel system and change fuel filters.

Step 3. Drain coolant and change coolant filters.

Step 4. Replace air filters.

Step 5. Insure all intake and exhaust ports are covered.

Step 6. Disconnect all generator supply connections.

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within --- hour.

Task 1.

LG #54	LO #5- Clean up
Instruction sheet	

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Clearing work area
- Disposing or recycling materials
- Cleaning, checking, maintaining and storing plant, equipment and tools

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Clear work area
- Dispose or recycle materials
- Clean, check, maintain and storeplant, equipment and tools

Learning Instructions:

Read the specific objectives of this Learning Guide.

Follow the instructions described below 3 to 6.

Read the information written in the information “Sheet 1 and Sheet 2”.

Accomplish the “Self-check-1” in page 57.

If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1 and Operation Sheet 2” in pages 58.

Do the “LAP test” in page – 60 (if you are ready).

Do the “cumulative LAP test or Final” in page – 62 (if you are ready).

Information Sheet-1	Clearing work area

1.1.Environmental management plan

The Environment Management Plan (EMP) would consist of all mitigation measures for each component of the environment due to the activities increased during the construction, operation and the entire life cycle to minimize adverse environmental impacts resulting from the activities of the project. It would also delineate the environmental monitoring plan for compliance of various environmental regulations. It will state the steps to be taken in case of emergency such as accidents at the sites including fire. The detailed EMP for the complex is given below.

The EMP is generally

Prepared in accordance with rules and requirements of the Environmental Protection Authority and the Environmental Units of Competent Sectoral Agencies

To ensure that the component of facility are operated in accordance with the design

A process that confirms proper operation through supervision and monitoring

A system that addresses public complaints during construction and operation of the facilities and

A plan that ensures remedial measures is implemented immediately

The key benefits of the EMP are that it offers means of managing its environmental performance there by allowing it to contribute to improved environmental quality. The other benefits include cost control and improved relations with the stakeholders.

The objectives of the EMP are to:

Identify a range of mitigation measures which could reduce and mitigate the potential impacts to minimal or insignificant levels;

To identify measures that could optimize beneficial impacts;

To create management structures that address the concerns and complaints of stakeholders with regards to the development;

To establish a method of monitoring and auditing environmental management practices during all phases of development;

Ensure that the construction and operational phases of the project continues within the principles of Integrated Environmental Management;

Detail specific actions deemed necessary to assist in mitigating the environmental impact of the project;

Ensure that the safety recommendations are complied with;

Propose mechanisms for monitoring compliance with the EMP and reporting thereon; and

Specify time periods within which the measures contemplated in the final environmental management plan must be implemented, where appropriate.

1.2. Preparation and implementation of the EMP

When preparing the EMP for a proposed activity, useful background information includes:

Documents from the EIA process (eg. Final Scoping Report and/or Environmental Impact Report) and Record of Decision, that provide the context for the EMP, and which should include background information on the proposed project, predicted positive and negative impacts, management actions to mitigate negative impacts and enhance positive impacts

High-level documents that set the framework for environmental management for the proposed activity, such as a Strategic Environmental Assessment (SEA), Strategic Environmental Management Plan (SEMP), over-arching Environmental Management System (EMS), or results from an Integrated Development Planning (IDP) process.

Local monitoring programs that the EMP would need to take into consideration.

Sometimes certain monitoring requirements for the project can be served by existing monitoring programs such as those carried out by a local authority.

Information on existing monitoring and liaison forums that the EMP could link with in terms of communication and reporting, such as an Environmental Monitoring Committee.

Environmental policies or guidelines from the project proponent that need to be applied to the EMP for a particular activity. This is particularly relevant for international companies.

Updated project information that may provide more detail than presented for the EIA. The EIA process may lead to more detailed investigations into implementation of certain mitigation actions. The findings of these investigations can be included in the EMP.

2.1. Cleaning tools and equipment

Equipment of all types should be cleaned at the location of last use before being moved to a new location.Different types of materials require different cleaning methods

Preclearing, by removing heavy accumulations of soil and debris with appropriate tools, will save water during later washing operations. Effective cleaning to eliminate invasive species materials and prevent their spread can be accomplished by thoroughly removing soil and debris using pressurized water. In certain situations, cleaning with compressed air, rather than water, could prevent damage to certain equipment areas such as engine wiring systems and vehicle cabs.
Personnel who use equipment during cleaning operations are responsible for properly using

Personal Protective Equipment (PPE) that is appropriate to the cleaning activity. Using cleaning and disinfectant chemicals, power washers, air compressors, and other types of cleaning equipment may present unique working hazards. PPE items may be required to protect hearing, skin, eyes, respiration, and other body resources. For example, certain types of cleaning equipment may require electrical power and may present electrical hazards to the operator.

Even the most careful cleaning of any equipment, however, will not guarantee that the equipment is absolutely free of contamination. Successful cleaning is dependent upon many factors, such as the amount of care taken during the cleaning operation, the type of cleaning equipment being used, the level of training of the cleaning operator, the type of equipment being cleaned, and the particular invasive species.

After decontamination, equipment should be handled only by personnel wearing clean gloves to prevent re-contamination. In addition, the equipment should be moved away (preferably upwind) from the decontamination area to prevent re-contamination. If the equipment is not to be immediately re-used it should be covered with plastic sheeting or wrapped in aluminum foil to prevent re-contamination. The area where the equipment is kept prior to re-use must be free of contaminants.

2.2. Checking of Equipment and Tools

This is designed to encourage all staff to check equipment and tools regularly for faults and condition and report defects to Management immediately and not to use defective tools or equipment.

Outcomes required

The overall intention is to raise awareness of using faulty tools or equipment and that all are aware of their duty of care to themselves and others of ensuring they do not. Also the

empowerment they have in not conducting unsafe acts by using and also in confidently raising with management issues with equipment and tools supplied by the company.

Self-Check – 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I <u>short answer</u>

1. Explain what Environment Management Plan mean (EMP)? List out the objectives of EMP. (5 Points)

2. Discuss how EMP is prepared and implemented? (5 Points)

1. Discus why Cleaning tools and equipment is important? (3 Points)

2. Discuss importance of checking for defects prior to use.(3 Points)

3. What is Equipment maintenance mean? Discuss why is needed?(2 Points)

4. Discuss briefly on the benefits of Proper Storage of Tools and Equipment's.(2 Points

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Information Sheet-2	Disposing or recycling materials

Disposal of Nonhazardous and Nonregulated Waste

Some nonregulated laboratory waste is hazardous and should be safely managed. There are more waste management options for nonregulated waste, especially with regard to hazard reduction procedures.

Some laboratories have policies that require all chemical waste to be handled as if it were regulated as hazardous. This recognizes the potential liabilities associated with misperceptions or the improper handling of nonregulated as well as regulated waste. For example, a trash hauler or landfill operator may become alarmed by a laboratory chemical container, even if it contains sucrose. Note that if different types of waste are comingled, though, then the mixture must be treated as hazardous waste, and the cost for disposal of the nonhazardous portion may increase. Also consider the possibility that a hazardous material may be improperly labeled or described as nonhazardous.

When safe and allowed by regulation, disposal of nonhazardous waste via the normal trash or sewer can substantially reduce disposal costs. Many state and local regulations restrict or prohibit the disposal of waste in municipal landfills or sewer systems, and so it is wise to check the rules and requirements of the local solid waste management authority and develop a list of materials that can be disposed of safely and legally in the normal trash. The common wastes usually not regulated as hazardous include certain salts (e.g., potassium chloride and sodium carbonate), many biochemicals, nutrients, and natural products (e.g., sugars and amino acids), and inert materials used in a laboratory (e.g., noncontaminated chromatography resins and gels). In some places, the laboratory's hazardous waste disposal firm may assist with disposal of nonregulated materials.

Treatment and Disposal Options

Federal regulations define treatment as “any method … designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize such waste, or so as to recover energy or material resources from the waste, or so as to render the waste nonhazardous or less hazardous ….” In most cases, treatment requires a state or federal permit. The regulatory procedures and costs to obtain a permit for treatment are beyond the resources of most laboratories. Under federal law, laboratory treatment of chemical hazardous waste without a permit is allowed in the following instances:

small-scale “treatment” that is part of a laboratory procedure, such as the last step of a chemical procedure;

a state that allows “permit-by-rule,” treatment, that is, by allowing categorical or blanket permitting of certain small-scale treatment methods;

elementary acid-base neutralization; and

treatment in the waste collection container (see for regulatory information).

To minimize costs and manage laboratory waste most efficiently, it is important to consider treatment and disposal options as early as possible, and plan ahead. For example, the method of waste collection impacts how waste will be stored, as well as its efficient transfer to a treatment or disposal facility. In addition to the hazard reduction procedures described above, laboratories utilize several treatment and disposal options because of the great variety of waste generated, and because each option (described below) has its own advantages for specific wastes, and so planning can be difficult. Although landfill disposal is not described separately below, it is often the disposal method for encapsulated waste, treatment residues, and ash from incineration. Note that disposal options change as technology and environmental concerns change. When feasible, waste minimization is always a best practice.

Treatment and Recycling

There are various methods for physical and chemical treatment of hazardous wastes, as well as methods for recycling, reclamation, and recovery of valuable materials contained in the waste. These methods include neutralization, oxidation-reduction, distillation, digestion, encapsulation, and several forms of thermal treatment. While the expense and practicality of these technologies is largely based on the specific nature and volume of the material, treatment or recycling is preferable to incineration for some hazardous wastes. For example, high- and low-pH wastes may be neutralized, resulting in treatable wastewater and salts. Incineration of mercury and other toxic metals is restricted; recycling, recovery, or encapsulation is environmentally preferred. Filtration of aqueous-based wastes may also significantly decrease volumes and result in wastewaters suitable for treatment in a sewage treatment facility. kilns.

Release to the Atmosphere

The release of vapors to the atmosphere, via, for example, open evaporation or laboratory chemical hood effluent, is not an acceptable disposal method. Apparatus for operations expected to release vapors should be equipped with appropriate trapping devices. Although laboratory emissions are not considered a major source under the Clean Air Act, deliberate disposal of materials via evaporation of vapors is strictly prohibited under RCRA.

Chemical hoods, the most common source of laboratory releases to the atmosphere, are designed as safety devices to transport vapors away from laboratory personnel, not as a routine means for volatile waste disposal. Units containing absorbent filters have been introduced into some laboratories, but have limited absorbing capacity. Redirection of hood vapors to a common trapping device can completely eliminate discharge into the atmosphere.

Waste Disposal - Disposal of Laboratory Wastes

Disposal Procedures

It is the clear responsibility of all lab workers to ensure the safe and correct disposal of all wastes produced in the course of their work. Improper and irresponsible disposal of chemical wastes down drains, to the Local Authority refuse collection, or into the atmosphere is forbidden by law. The Aldrich Handbook provides a useful summary of the correct disposal procedure for most chemicals.

Due to new legislation, increasingly strict environmental controls and the escalating costs of disposal, it is essential that the appropriate disposal procedures given below are strictly adhered to:

Wash down drains with excess water

Concentrated and dilute acids and alkalis

Harmless soluble inorganic salts (including all drying agents such as CaCl2, MgSO4, Na2SO4, P2O5)

Alcohols containing salts (e.g. from destroying sodium)

Hypochlorite solutions from destroying cyanids, phosphines, etc.

Fine (tlc grade) silica and alumina

It should be noted in particular that no material on the "Red List" should ever be washed down a drain. This list is as follows:

compounds of the following elements:- antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, tellurium,

mineral oils and hydrocarbons.

Laboratory waste bins and controlled waste

All waste suitable for the Local Authority refuse collection, except recyclable paper and glass, is termed 'controlled waste'. Items in this category which includes dirty paper, plastic, rubber and wood, should generally be placed in the waste bins available in each laboratory and will be collected by the cleaners. However, each laboratory must also have a container for certain items which are not allowed to be put in the normal waste bins. In this special controlled waste container should be put:- all broken laboratory glassware, any sharp objects of metal or glass, all fine powders (preferably inside a bottle or jar) and dirty sample tubes or other items lightly contaminated with chemicals (but not any syringes or needles). Laboratory controlled waste containers must be emptied regularly and never allowed to overflow. Under no circumstances must any item of glass, sharp metal or fine powder ever be put in a normal laboratory waste bin. The tops must be removed

from all bottles put out for disposal and there should be no detectable smell of chemials from any bottle put for disposal.

Self-Check – 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I

1. How we can transport wastet to disposal site

Note: **Satisfactory rating - 6points** **Unsatisfactory - below 6**

You can ask you teacher for the copy of the correct answers.

Score = _____
Rating: _____

Answer Sheet

Name: _____ Date: _____

Test I

_____

Information Sheet-3	Cleaning, checking, maintaining and storing plant, equipment and tools

Introduction

Raw materials form a critical part of manufacturing as well as service organization. In any organization, a considerable amount of material handling is done in one form or the other. This movement is either done manually or through an automated process. Throughout material, handling processes significant safety and health; challenges are presented to workers as well as management. Therefore, manual material handing is of prime concern for health and safety professional, and they must determine practical ways of reducing health risk to the workers.

Material Handling

Manual material handling ranges from movement of raw material, work in progress, finished goods, rejected, scraps, packing material, etc. These materials are of different shape and sizes as well as weight. Material handling is a systematic and scientific method of moving, packing and storing of material in appropriate and suitable location. The main objectives of material handling are as follows:

It should be able determine appropriate distance to be covered.

Facilitate the reduction in material damage as to improve quality.

Reducing overall manufacturing time by designing efficient material movement

Improve material flow control

Creation and encouragement of safe and hazard-free work condition

Improve productivity and efficiency

Better utilization of time and equipment

It is critical for manufacturing organization to identify importance of material handling principle as the critical step in promoting the job improvement process. Manual material handling significantly increases health hazard for the workers in from lower back injuries.

In the current competitive and globalized environment, it is important to control cost and reduce time in material handling. An efficient material handling process promotes:

- ✓ Design of proper facility layout
- ✓ Promotes development of method which improves and simplifies the work process
- ✓ It improves overall production activity.
- ✓ Efficient material handling reduces total cost of production.

Principles of Material Handling

Material handling principles are as follows:

Orientation Principle: It encourages study of all available system relationships before moving towards preliminary planning. The study includes looking at existing methods, problems, etc.

Planning Principle: It establishes a plan which includes basic requirements, desirable alternates and planning for contingency.

Systems Principle: It integrates handling and storage activities, which is cost effective into integrated system design.

Unit Load Principle: Handle product in a unit load as large as possible

Space Utilization Principle: Encourage effective utilization of all the space available

Standardization Principle: It encourages standardization of handling methods and equipment.

Ergonomic Principle: It recognizes human capabilities and limitation by design effective handling equipment.

Energy Principle: It considers consumption of energy during material handling.

Mechanization Principle: It encourages mechanization of handling process wherever possible as to encourage efficiency.

Flexibility Principle: Encourages of methods and equipment which are possible to utilize in all types of condition.

Simplification Principle: Encourage simplification of methods and process by removing unnecessary movements

Gravity Principle: Encourages usage of gravity principle in movement of goods.

Safety Principle: Encourages provision for safe handling equipment according to safety rules and regulation

Computerization Principle: Encourages of computerization of material handling and storage systems

System Flow Principle: Encourages integration of data flow with physical material flow

Layout Principle: Encourages preparation of operational sequence of all systems available

Cost Principle: Encourages cost benefit analysis of all solutions available

Equipment maintenance

Tools and equipment must be maintained if they are to be operated in a safe and effective manner. Elements of good maintenance requirements include:

Inspection of the tools and equipment at must occur checkout or start-up of the job. This can include such items as a visual inspection of the power cord to make sure it is not damaged, visual inspection to make sure equipment parts are securely attached, and inspection for cleanliness.

Inspection of tools and equipment must also occur at check in or at completion of the job. This should include cleaning the tools after use, reporting any problem with the tool or equipment while in use, draining any excess fuel or flammable fluids from the equipment.

Routine maintenance as per the manufacturer's requirements should be carried out.

Proper Storage of Tools and Equipment:

To ensure that tools and equipment remain in good condition and last for a long time, store them properly. Properly stored tools and equipment will be easy to find when needed and are less likely to be lost.

Example: Good practices for mechanical room

Parts should be properly stored and labeled	
Tools should be properly placed on the board, and labeled. Consider drawing the shapes of the tools on the board so that they always get put back in the same position.	
Use bins for storing small parts of taable	
Consider making an individual (or individuals) responsible for the good maintenance of tools and	

parts.

2.4.1. Benefits of Proper Storage of Tools and Equipment:

- ✓ Tools and parts are kept in good condition and are easy to find
- ✓ Costs are reduced
- ✓ Productivity is increased because time is not lost looking for tools, parts and equipment
- ✓ Workshop staff develop a sense of responsibility and pride in their work
- ✓ Workshop staff identify tools, parts and equipment
- ✓ Workshop staff develop a system for labeling and storing tools, parts and equipment

Self-Check – 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I

1. what is material handling?

2. List five material handling tools?

Note: **Satisfactory rating - 6points** **Unsatisfactory - below 6**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Test I

_____

Operation Sheet 1	CONTENT-

DO NOT use this machine unless a teacher has instructed you in its safe use and operation and has given permission

Safety glasses must be worn at all times in work areas.

Appropriate hearing protection (*Class 5- SLC_{80}>26 dB*) must be worn.

Appropriate protective footwear must be worn.

Wear a hard hat if required.

Rings and jewellery must not be worn.

Wear an approved dust mask (*P2 dust and fumes)*.

Use compressed air safely – horseplay with compressed air can cause injuries

PRE-OPERATIONAL SAFETY CHECKS

Ensure the work area is well ventilated and not interfering with other students or activities.

Visually check all air hoses and electrical leads used with the compressor for damage and slip/trip hazards.

Ensure all guards for the compressor (e.g. belt and pulley cover) are in place and in good working order.

Ensure you are familiar with the operation of the ON/OFF switch.

Check that the regulator is set to the appropriate pressure for the activity.

Check the oil level of the compressor in the oil sight glass.

Operational safety checks

Ensure all attachments used with the air compressor are in good condition before using.

Be careful when attaching and disconnecting tools to the air hose. Hold the air hose and tool firmly during this process.

Check the compressor regularly, noting pressure increase and cut-out/cut-in pressure.

Listen for any air leaks from any flexible airlines and immediately report any leaks.

Adjust pressure regulator to suit work requirements – discuss with your teacher.

Turn off and disconnect air hoses and electrical leads after use.

Never leave air compressor and equipment unattended.

Housekeeping

Leave the work area in a safe, clean and tidy state – remove any waste.

Release condensation from the drain before storing air compressor away.

Air hoses and electrical leads should be coiled with large loops.

Potential hazards

- ✓ Material blown under pressure
- ✓ Unrestrained air hose whipping around
- ✓ High pressure air hose couplings
- Slips, trips and falls
- Compressed air
- Manual handling – equipment and materials
- Excessive noise

Forbidden

- ✓ Never use compressed air to clean off clothes, workbenches or floor surfaces
- ✓ Never direct compressed air at your body or another person.

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within --- hour.

Task 1.

Task 2.

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