DairyProductsProcessing Level-II

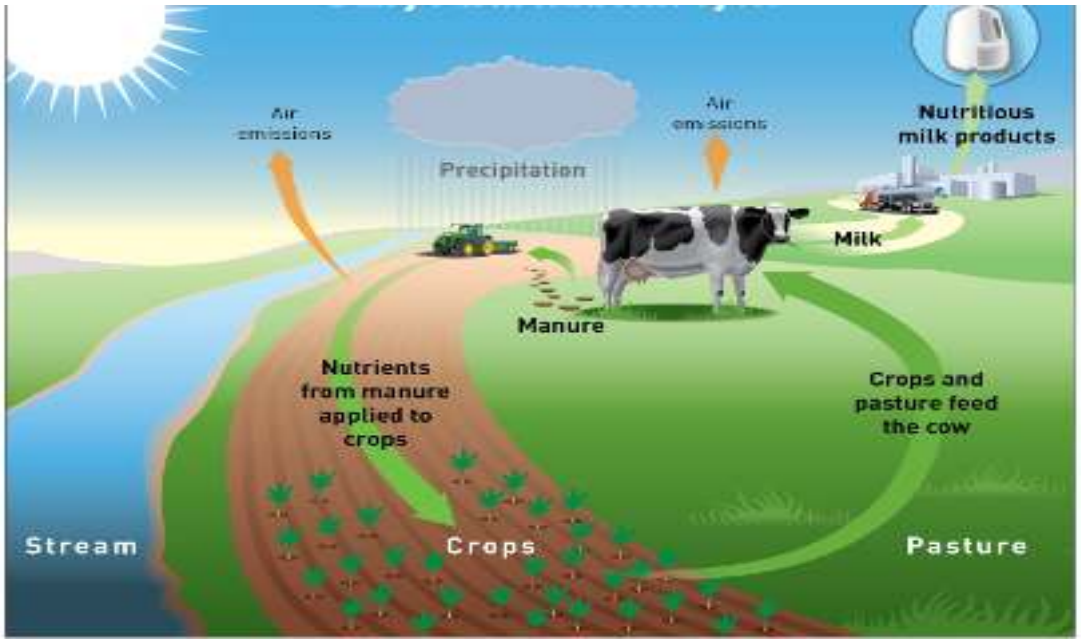

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Table of Contents

Introduction to the Module

This unit convers the knowledge, skills and attitudes required to effectively measure current resource use and carry out improvements including those reducing negative environmental impacts of work practices and practice in obtain and provide information in response to Workplace requirements.

LG #1	LO 1 Identify Current resource use and Environmental issues

Instruction sheet-1

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

- Identifying environmental and resource efficiency
- Identifying resources in work
- Measuring and recording of resources using appropriate techniques
- Identifying and reporting workplace environmental hazards

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:

- Identify environmental and resource efficiency
- Identify resources in work
- Measure and record of resources using appropriate techniques
- Identify and report workplace environmental hazards

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks
5. Perform Operation Sheets
6. Do the “LAP test”

Information Sheet- 1

1.1 Identifying environmental and resource efficiency

1.1.1 Introduction

An Environment is everything that is around us, which includes both living and non-living things such animals, plants, forests, fisheries, and birds, include water, land, sunlight, rocks, and air, which adapt themselves to their surroundings. It is nature's gift that helps in nourishing life on Earth. Ecology and Environmental science are the branches of life science, which mainly deal with the study of organisms and their interactions with other organisms and their environment.

Environment plays an important role in healthy living and the existence of life on planet earth. Earth is a home for different living species and we all are dependent on the environment for food, air, water, and other needs. Therefore, it is important for every individual to save and protect our environment.There are different types of human activities which are directly attributed to the environmental disasters, which include- acid rain, acidification of oceans, change in the climate, deforestation, depletion of an ozone layer, disposal of hazardous wastes, global warming, overpopulation, pollution, etc..

1.1.2 Environment and Resource efficiency

At the moment, the world way of life and economy are based on wasteful use of natural resources, which risks the well-being of humans and animals through climate change and the depletion of biodiversity. This has become an increasingly widely recognized issue, and the world too has become concerned about the growing scarcity of natural resources and global competition over them, especially with regard to critical natural resources.Sustainability in dairy production and processing is known as the best technique to undertake dairy processing in more suitable and sustainable condition which ensure the continuity of the practices, guarantee the economics, social of the people and also preserved the good environment.

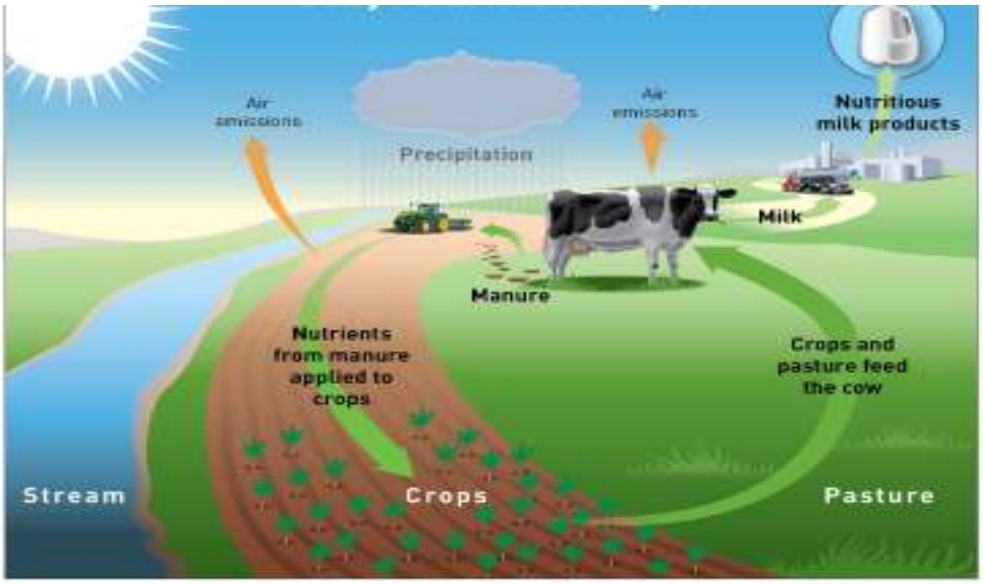

Figure 1.1 dairy and environment relationship

1.1.3 Identifying environmental and resource efficiency issues

Environmental and resource efficiency issues revolve around the dairy processing organization's efforts to maximize its performance while minimizing its waste and environmental impact. Improving environmental performance may be done as part of good business practice, from a desire to improve the environment or to improve relations with employees, customers, local communities and the general public.

Environmental and resource efficiency issues may include:

- Minimization of environmental risks related to the processing plant.
- Maximization of opportunities to improve business environmental performance.
- Promote more efficient production and consumption of natural resources.
- Establishment of wise use of resources.

1.1.4 Identifying resources in dairy processing plant

A nonrenewable resource is a natural substance that is not filled with the speed at which it is consumed and it is a finite resource. Dairy processing facilities consume considerable amounts of energy which are used to generate hot water and produce steam for process applications, drive processing machinery, refrigeration, ventilation, and lighting, pasteurization, evaporation, and

milk drying and cleaning purposes. Energy consumption resources may use in dairy processing plant includes:

- Electricity
- Diesel,
- Coal,
- Natural gas, etc.

1.2 Identifying resources in work

1.2.1 Efficient use of resources

All resources which are found in the processing plant should be utilized effectively and efficiently to minimize wastage and cost of production since the profitability of the organization is determined by this resource utilization.

Economic effects of resource efficiency

Resource efficiency allows economies to create more from less, i.e. to add more value with smaller inputs. Measures that promote resource efficiency;

- Evaluation of lifetime environmental impacts and eco-efficient product development
- Adoption of measures that increase the efficiency of recycling and reuse
- Promotion of bio economy and renewable forms of energy
- Development of innovation partnerships

1.2.1 Type of waste produced during dairy products processing

The effluent is responsible for the major environmental impact of the dairy industry. The processing of dairy products can result in wastes from milk fermentation or by-products from the processing, which could be used in the preparation of other dairy products, such as whey concentrates from cheese whey. Dairy wastes, generally, have suspended solids and organic matter, high content of nitrogen and phosphorous.

1.2.2 Composition and characteristics of dairy industrial waste

Waste from the food industries, including dairy industry, contains high level of organic matter, oil and grease, fatty acid and considerable nitrogenous compounds. Dairy wastewater generally contains high concentration of dissolved organic components, such as lactose, minerals, fat and whey protein.

There are diverse products from the dairy industry, such as sterilized and pasteurized milk, cheese, cream, butter, ice cream, yogurt, and milk powder. Production of products and packaging unit are responsible for wastewater generation. Wastewater in the packaging unit is generated during cleaning of jars, tanks, bottle and other packaging related equipment. Mostly, dairy effluents include milk or milk products which are lost in technological

1.2.3 Harmful environmental effects of dairy industrial effluents

Effluents from dairy industry are concentrated in nature, and carbohydrates, protein and fats from milk act as main contributors to organic load of these effluents. Due to presence of high concentrated organic matter in the dairy waste stream, serious problems could rise, especially in the local sewage municipal system in term of organic load. Pollution due to dairy industry affects the air, soil and water quality.

Dairy industry is a major food processing sector which utilizes high water quantity and generates high quantities of dairy effluent. The composition of the waste varies from industry to industry and information on composition wastewater streams is limited.

1.2.4 Waste management in dairy industry

Waste management is the collection, transport, processing, recycling or disposal, and monitoring of waste materials.

Type of dairy wastes can be classified as

- solid wastes,
- Liquid wastes,
- Oily wastes,
- Gaseous wastes/water vapors

A. Solid wastes

Solid organic waste in dairy processing facilities mainly originates from production processes and includes nonconforming products and product losses like;

- Milk spillages liquid whey and buttermilk)

- Grid and filter residues
- Sludge from centrifugal separators and wastewater treatment,
- Packaging waste (discarded cuts, spent ripening bags, wax residues from cheese production).

B. Liquid wastes these refer to those wastes which are obtained in liquid form as a result of processing, cleaning, flushing etc. The wastes resulting from processing may include un-reacted raw materials, impurities or byproducts generated in process because of operational deterioration, e.g., if the milk is not pasteurized at the right time and if it becomes sour then it will be dumped in the drain. Water used for cleaning purposes, acid, and lye as used in the cleaning in place also comes under these wastes.

C. Oily wastes

These wastes results from the leakage in compressors, hydraulic machines, crankcase, and coolant leakage and motors where oil is required for lubrication. These wastes are differentiated from liquid wastes because they need a different disposal method.

D. Gaseous wastes/water vapors

These wastes refer to those released in the air in the form of gases or volatile vapors. The obnoxious fume from the chimney is a gaseous waste and pollutes the environment to a major degree.Gaseous wastes from processing plants include the water vapors formed in a concentrating section. These vapors increase the relative humidity of the surrounding and the energy they carry with them is wastage to the plant.

1.2.5 Waste Minimization

As per Industrial Waste Management Policy premises which are subject to works approval require waste management plans incorporating waste minimisation.

Each dairy plant should therefore assess opportunities for reducing waste arising from its operations. Waste reduction measures may include:

- Reducing use of water
- Reducing use of chemicals

- Recycling water and chemicals,
- Recovery and reuse of product from first reuse
- Reuse/reprocessing of off-spec material
- Recovering and reusing spilled raw materials and products

1.2.6 How to control dairy waste?

Dairy establishment and the products made affect the nature and concentration of dairy wastes. Most site losses come from activities associated with liquid handling and, to a lesser extent, with the discharge of air and solid waste.The amount of product lost depends on design and operational factors including:

- The range of process technologies in use.
- The availability of adequate process monitoring, and plant and procedure alarms/interlocks.
- The availability of automated operation – especially automated clean-in-place (CIP) systems and procedures.
- The level of management and operator commitment, training and efficiency.
- The level of routine equipment maintenance.

Avoidable losses

Some examples of avoidable losses are:

- Leaking valves, pumps, pipelines or other fittings – the volume lost may not be large but the pollution load may be great
- Spills from overflows, malfunctions and poor handling procedures – spills usually happen over a short period but the amount and the high concentration of milk or product lost may be a significant increase in the pollution load
- Losses from processing and cleaning during the normal operation of plant and equipment.

1.2.7 Waste reduction

Mostly dairy processing waste comes from the deliberate discharge of unwanted materials such as whey, spent cleaners and diluted product not thought to be worth recovering. Liquid milk production may lead to the generation of odour, wastewater, noise and solid waste. Best practice

involves processing the predominant by-products such as whey, buttermilk and skim milk, into high value products like skim milk powder, buttermilk powder, whey powder, whey protein concentrate and casein, rather than being used as low value animal feed/fertilizer or being dumped as waste.

Waste reduction can be achieved by;

- Not overfilling cheese vats to stop curd loss.
- Completely removing whey and curds from vats before rinsing.
- Segregating all whey drained from cheese.
- Sweeping up pressings (particles).
- Screening all liquid streams to collect fines

1.3 Measuring and recording of resources using appropriate techniques

1.3.1 Introduction

The purpose of recording is to provide reliable evidence of information about product and processing that affect environmental Record keeping system should be accurate, reliable, easy to follow, consistent as to the basis used and be very simple.

1.3.1 Recording dairy product and processing operation affect environment

Type of recording and documenting process

A. Collect Data To undertake this assessment, you need to collect the following information:

- The quantity of resources used by type.
- The quantity of production or activity at the site by type.
- The quantity of waste generated by type.
- The quantities of input output and calculate waste.
- Separation or estimation of the amount of water used.

B. **Analyze Data** Look for patterns in your data and consider the seasonal aspects that affect your resource use or waste generation. Compare the resource consumption and waste generation to dairy industry. Some industries have resource efficiency indicators that are already set.

C. **Establish** a Baseline Period Using the information collected, you will need to establish baseline data. It is the data will use to evaluate your improvements against and it should be current data.

D. **Identify Activities** When analyzing your data; it is preferable to divide it by activities at your workplace rather than departments or sections. Use of resources and the waste generated is usually relevant to particular activities so this will give you more accurate information to work with. You will need to start by listing all the common activities.

E. **Estimate Resource** Use and Waste Generation for Key Activities As the use of resources and the wastes generated are often inter-related; you should firstly undertake an integrated mass and energy balance for the whole site. When estimating the resource use and waste generation for each activity, remember these key principles:
Sum (individual activity resources/wastes) = Total resource/wastes
Sum (inputs) = sum (outputs)

1.4 Identifying and reporting workplace environmental hazards

1.4.1 Introduction to Environmental Hazards

An environmental hazard is a substance or entity in the environment that poses the threat of harm to a living organism in an environment. The environment consists of key components that are needed to sustain life: air, water, food, and shelter. An environmental hazard that is present in one or more of the key components needed to sustain life poses a risk to the health of the humans present in the environment.

1.4.2 Environmental Health Hazards

Environmental hazard pose a risk to human, animal and plant. An environmental hazard may be naturally occurring, such as the environmental hazard created by the chemicals released by a poisonous plant. These naturally occurring hazards are often related to a specific plant or animal

species, or natural processes such as rust or decay. In considering the impact of human-created environmental hazards, the benefits and threats must be carefully analysed to determine whether an environmental hazard provides sufficient benefit to make the hazard worth the risk to human health.Environmental health hazards may consist of:

- Physical,
- Chemical,
- Biological

1.4.3 Examples of Environmental Hazards

- **Air contaminants** such as air pollution that results from manufacturing and production have been worsened by human and technological systems. Air pollution results in negative health consequences such as:
  - ✓Damage to the respiratory,
  - ✓Neurological,
  - ✓Immune, and
  - ✓Reproductive systems of humans who live in heavily polluted areas.

- **Toxic waste** is created by the manufacturing and production processes. Toxic waste contains harmful chemicals that impact the health of plants and animals that come into contact with the waste in their environment.
- **Microorganisms** include viruses, bacteria, and other infectious pathogens. These pathogens harm living organisms by attacking immune systems, resulting in an array of negative health consequences. Microorganisms are naturally occurring but are transmitted as a result of human interactions.

- **Pesticides** are human-made environmental hazards that are created due to food production. Pesticides are important because they increase food production abilities, but pesticides pose an environmental threat because they contain chemicals that are designed to kill insects and other pests that consume raw food.

- **Radiation** exposure is an environmental hazard that results in increased cancer risks. An acute exposure event can lead to radiation sickness which includes symptoms such as nausea, vomiting, and death if the acute exposure is prolonged.
- **Chemicals** found in consumer products are continuously being identified to pose environmental health pressures like preservative.
- **Extreme weather conditions** and natural disasters pose physical health risks to humans and other living organism.

1.4.4 Reporting Workplace Environmental Hazards

Once you have identified a gap in your processing organization, you should report it to the appropriate personnel.

Method of manage /control hazards at work.

- Hazard Identification
- Risk Assessment
- Make the changes risk control

Environmental Hazard Report Form

Grade: ----------.

Incident No.: ----------.

Date entered: ----------.

Name: ----------.

This section is to be completed by the employee involved and handed to the manager or supervisor within 24 hours.

Employer: Sustainable Workplace,

This is an: Incident Accident Near Miss Minor injury, Major injury, Property damages

Other (Specify): ----------.

Time of occurrence: am/pm Date of occurrence: ----------.

Location/address of occurrence: ----------.

Describe what happened and include: exact location of the occurrence within the workplace; details of any plant and equipment involved; the process or substance involved. Attach separate sheet if insufficient space: ---------- ----------.

Name of person/s involved in the incident or injured:

First name: ---------- Surname: ----------

Position: ----------

(If more than one person attaches a separate sheet).

Risks or potential risks identified: ---------- ---------..

Observers: ----------.

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 (15 Points)

1. Explain Energy consumption resources may use in dairy processing plant(5 point)
2. Write Environmental health hazards (5 point)
3. Definition of environment 5 points

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

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

LG#2	LO2: Comply with Environmental Regulations

Instruction sheet-2

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

- Following Procedures to ensure compliance
- Reporting environmental incidents

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:

- Follow procedures to ensure compliance
- Report environmental incident to appropriate personnel

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
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6. Do the “LAP test”

Information Sheet-2

2.1 Following procedures to ensure compliance

2.1.1 What environmental regulation

Environmental regulations are rules and requirements that consider several aspects of environment. For instance, it includes 1) measures related to pollution control and 2) the way out to reach sustainable development by regulating how much pollution a system releases.

2.1.2 Procedure to ensure compliance

Compliance means following a rule or order or command for a specific task or operation. All dairying facilities must Compliance includes meeting relevant government laws, regulations and mandated codes of practice. The government of the Federal Democratic Republic of Ethiopia has placed a high premium on the environment. It has established the Environmental Protection Authority (EPA) by the proclamation no 9/1995 with statutory responsibility for overall protection of the environment.

2.1.3 How to Ensure Compliance in the Workplace

- Document any rules your employees need to follow.
- Consistently apply those policies and procedures.
- Take a positive approach instead of just saying “no”
- Invest in employee training.
- Use positive reinforcement for doing the right thing.
- Keep employees engage.
- Write your procedures down
- Make your procedures easily accessible:
- Reward employees who comply with procedures:
- Recognizing and rewarding correct behavior is a great motivator for employees.

2.2 Reporting environmental incidents

It is critical that all environmental incident reports are recorded and managed properly in the workplace, regardless of severity. All types of environmental incidents should be recorded via a dedicated and workplace specific environmental report form with follow up management processes involving the investigation, risk assessment, corrective actions and sign off. Environmental incidents which involve the planned or unplanned releases of substances from our processing plant and equipment that could be environmentally harmful to air, water, and/or land, including both noise and radiation and the discovery of historical contamination that has the potential for impacting nearby sites.

2.2.1 Environmental incident reporting guideline:

- Reporting environmental incidents;
- Ensuring corrective actions are effective;
- Establishing preventive actions to reduce the likelihood of incidents recurring; and
- Reviewing environmental incidents to inform continual improvement.

2.2.2 Component of reporting

Fields on the registry might include date of environmental incident or breach, date reported, site, exact location, type of environmental incident, causes, immediate actions and responsible person.The incident reporting form requires that certain information be provided as below:

- Date of environmental incident or breach,
- Date reported
- Site
- exact location,
- Type of environmental incident,
- Environmental factor and causes
- immediate actions,
- Severity

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: Give short answer. (10 Points)

1. Discuss the word compliance? (2 point)
2. Discuss environmental incidents. (3 point)
3. What are the component of reporting ?(2 point)
4. What is environmental regulation? (3 point)

Note: Satisfactory rating – 5 points Unsatisfactory – below 5 points

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

LG #3	LO3: Seek Opportunities to Improve Environmental Practices and Resource Efficiency

Instruction sheet-3

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

- Following enterprises plan
- Making suggestions for improvements

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:

- Following enterprises plan
- Making suggestions for improvements

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
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Information Sheet 3

3.1 Following enterprises plan

Ethiopian Water Resources Management Policy Proclamation No. 197/2000, the overall goal of this policy is to enhance and promote all national efforts towards the efficient, equitable and optimum utilization of the available Water Resources of Ethiopia for significant socioeconomic development on sustainable basis. The following policy issues are depicted:

- Create appropriate mechanisms to protect the water resources of the country from pollution and depletion
- Recognize that water supply and sanitation services are inseparable and integrate the same at all levels through sustainable and coherent framework.
- Promote the "User Pays" principle for urban water supply and sanitation services.
- Promote as far as possible, that the development as well as the operation and maintenance of water supply and sanitation systems are carried out at decentralized and appropriate body.

A formal business plan is the basis for financing proposals. The business plan answers investors' questions such as: Is there a need for this product/service? What are the financial projections? What is the company's exit strategy? While investors will generally want to meet you in person before writing you a check, in nearly all cases, they will also thoroughly review your business plan. Following enterprise plan is useful to:

- Establish business milestones.
- Better understand your competition.
- better understand your customer
- Assess the feasibility of your venture.
- Document your revenue model.
- Attract investors.

3.2 Making suggestion for improvements

Work in partnership with all concerned for water supply, drainage and wastewater master plans in major urban areas and prepare water supply and sanitation strategies in rural and other urban centres. Suggestions for the prevention of dairy waste listed below:

- The use of adequate equipment for receiving, cooling, storing and processing of milk, so as to take care of the maximum volume of flush production and of special products. All piping, around storage tanks and other areas, should be checked on miss-assembly and damage that may lead to leakage
- Instruction of plant personnel concerning the proper operation and handling of dairy processing equipment.
- Accurate temperature control on plate, tubular and surface coolers to prevent freeze-on, which may result in loss of products.
- Elimination of valves on the outlet sides of internal tubular or plate heaters and coolers and maintenance of plates and gaskets in good repair so as to eliminate waste due to blown or broken gaskets
- Installation of suitable liquid level controls with automatic pump stops, alarms, and other devices at all points where overflows could occur (storage tanks, processing tanks, filler bowls etc.).
- Keeping in good order of vats, tanks and pipelines so as to eliminate and reduce to a minimum the number of leaky joints, gaskets, packing glands and rotary seals.
- Proper design and installation of vats and tanks at a level high enough above the floor for easy drainage and rinsing if hand cleaned. Tanks should be pitched to insure draining.
- Correct connections on plate type heat exchangers so as to avoid milk being pumped into the water side of the exchanger or water being pumped into the milk side.
- Provision and use of proper drip shields on surface coolers and fillers so as to avoid that product reach the floor. Avoidance of cheese vats, vat processors or cooling tanks being overfilled so that no spillage occurs during product agitation. The liquid level in cheese vats should be at least three inches below the top-edge of the vat.
- Avoidance of foaming of fluid dairy products, since foam readily runs over processing vats and other supply bowls and contains large amounts of solids and BOD. The use of air tight

separators, proper seals on pumps and proper line connections to prevent inflow of air when lines are under partial vacuum, will avoid foam production.

- Turning off of water hoses when not in use. Use should be made of hoses equipped with automatic shut-off valves so as to avoid excessive water usage.
- Using Wastewater treatment technologies classified under following Primary treatment, Secondary treatment and Tertiary treatment

https://www.youtube.com/results?search_query=Making+suggestion+for+improvements+dairy+proessing+industry+waste+management

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 1: Short Answer Questions (6 points)

1. Write importance of following enterprises plan?
2. What is suggestion provided for improving waste management in dairy processing industry?

Note: Satisfactory rating - 5 points Unsatisfactory - below 5 points

LG #4	LO4- Work as a Team Member

Instruction sheet-4

This learning guideisdevelopedtoprovideyouthenecessaryinformationregardingthefollowing content coverage and topics:

- Using effective and appropriate forms of communications
- Making appropriate contributions to complement team activities.
- Observing protocols using standard operating procedures
- Contribute to the development of team work plans

Thisguidewillalsoassistyoutoattainthelearningoutcomesstatedinthecoverpage. Specifically, upon completion of this learning guide, you will be able to:

- Use effective and appropriate forms of communications
- Make appropriate contributions to complement team activities.
- Observe protocols using standard operating procedures
- Contribute to the development of team work plans

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
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Information Sheet-4

4.1 Using effective and appropriate forms of communications

4.1.1 Forms of communication

Communication means transferring messages from one to another through any medium. There are various levels in communication like Intrapersonal communication, Interpersonal communication, Group communication and mass communication.Mass communication plays the vital role because it reaches very large number of audience.

Basically mass communication has two forms one is Interpersonal communication and another one is media communication.

- **Five major forms of communication**

✓ **Intrapersonal Communication**

Intrapersonal communication is a communication which happens yourself. Here both Source (sender) and receiver is only one. So, the feedback works without any interruption. Example: A person can communicate himself through pain, thinking, feelings and emotion etc.

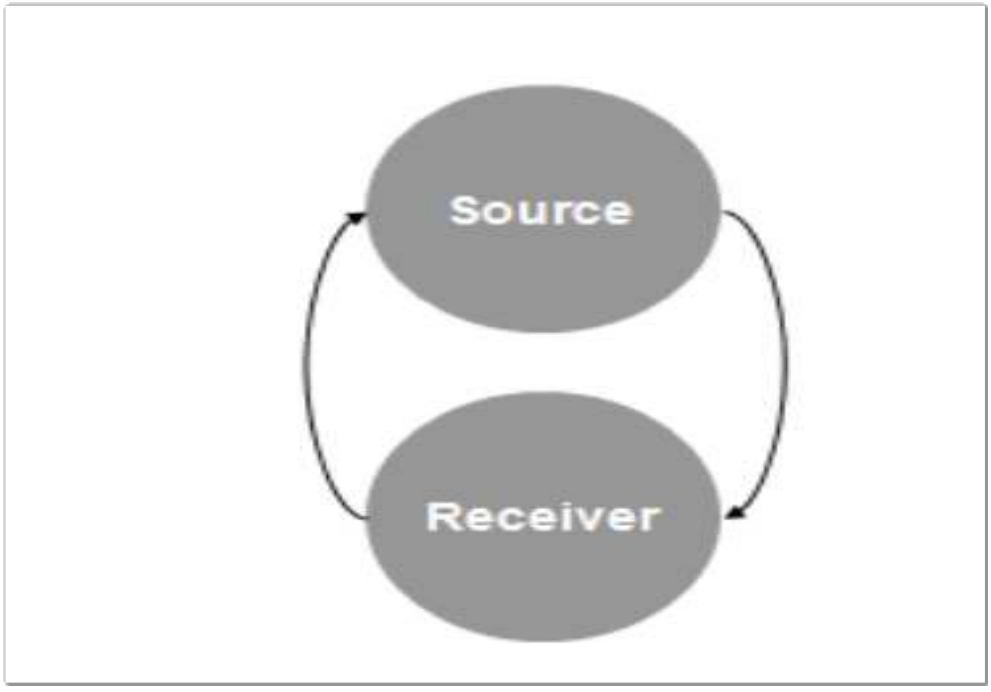

Figure 4.1 Intrapersonal communication

✓ **Dyadic Communication**

In dyadic communication, two persons are involved in this communication process. Here the Source becomes a receiver and receiver become source because of dynamic communication process were the feedbacks are shared between Source and the receiver.

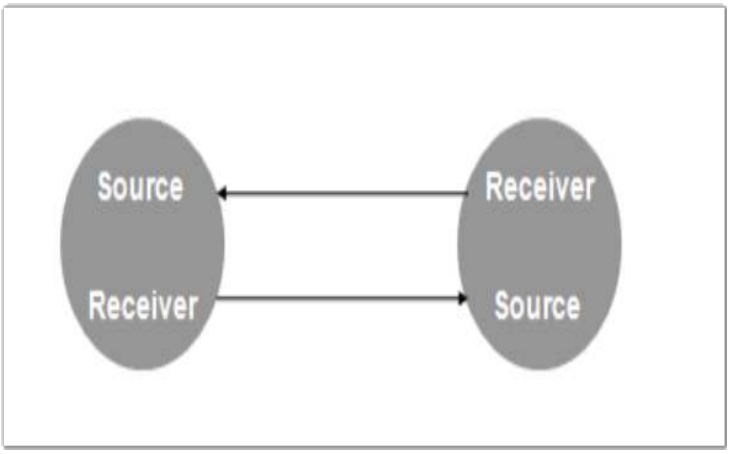

Figure 4.2. Dyadic Communication

- ✓ **Small Group Communication**

More than two members involved in communication process will become a group communication. If least number of persons is involved in the group communication is called as small group communication. In this communication process, everyone becomes a Source as well as receiver through sharing information and gives feedback to another.

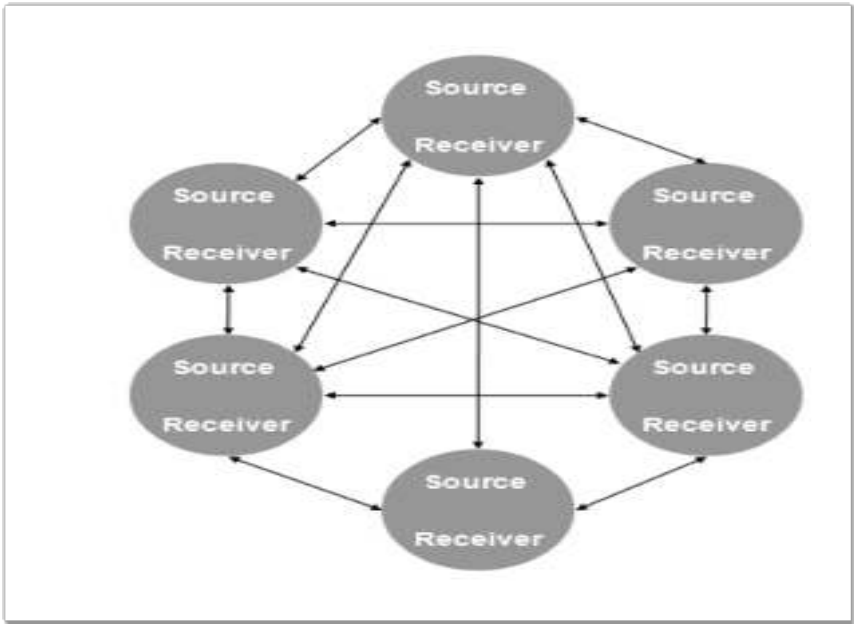

Figure 4.3. Small Group Communication

✓ **Public Communication**

In public communication, Source or messages from a single person will reach or received by huge number of audience. But in this communication there is no mutual feedbacks between source and receiver like small group communication and it's only focused on Speaker.

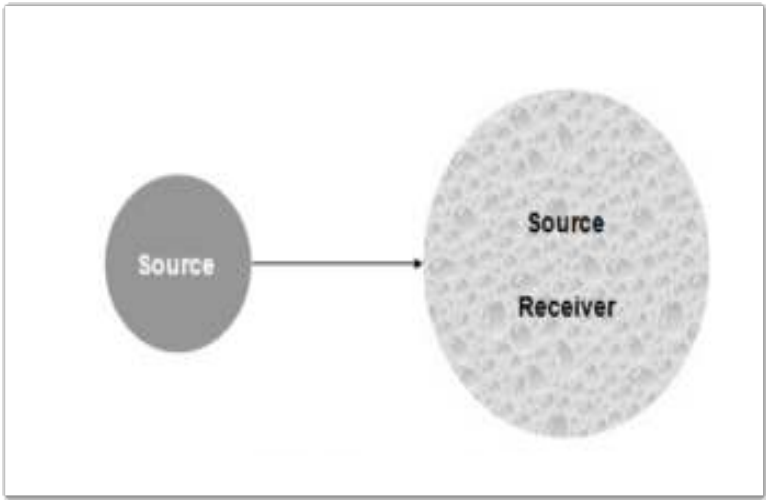

Figure 4.4Public Communication

✓ **Mass Communication**

In mass communication, basically have a large number of audience and they are all can't grouped together in one place so we need certain tool or technology for communication process. But in mass communication, there is no direct access with receiver. So, for that they need media like newspaper, radio, television and internet. Here the audience feedback is very less or delayed.

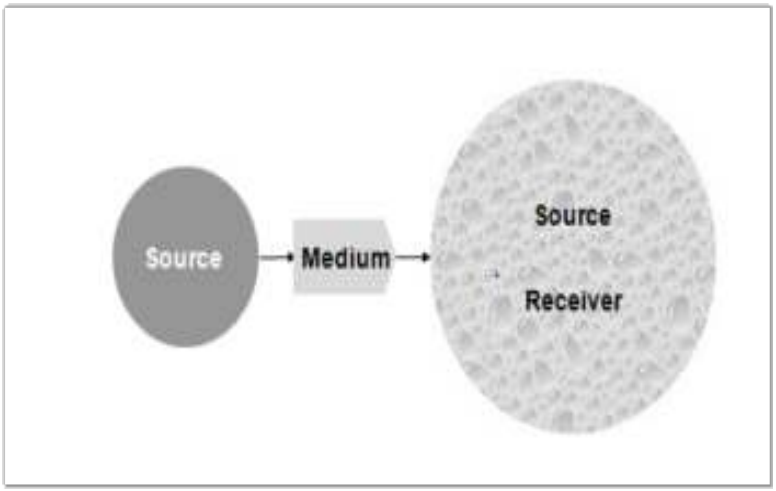

Figure 4.5. Mass Communication

4.1.2 Types of Communicationand Channels

There are three types of communication, including: verbal communication involving listening to a person to understand the meaning of a message, written communication in which a message is read, and nonverbal communication involving observing a person and inferring meaning. Let's start with verbal communication, which is the most common form of communication.

- **Verbal Communication**

Verbal communications in business take place over the phone or in person. The medium of the message is oral. Let's return to our printer cartridge example. This time, the message is being conveyed from the sender (the manager) to the receiver (an employee named Bill) by telephone.

- **Written Communication**

In contrast to verbal communications, which are oral, written business communications are printed messages. Examples of written communications include memos, proposals, e-mails, letters, training manuals, and operating policies.

- **Nonverbal Communication**

Non-verbal communication occurs without using any oral or written word. Instead of written or oral words, it relies on various non-verbal cues like physical movements, tasks, colors, signs, symbols, signals charts, etc. to express feelings, attitudes or information.

✓ **Common types of nonverbal communications**

- Facial expressions
- Eye contact
- Gestures
- Posture and body orientation
- Body Language
- Space and Distance
- Proximity
- Para-linguistic
- Humor
- Touch
- Silence
- Personal Appearance
- Symbol
- Visual Communication

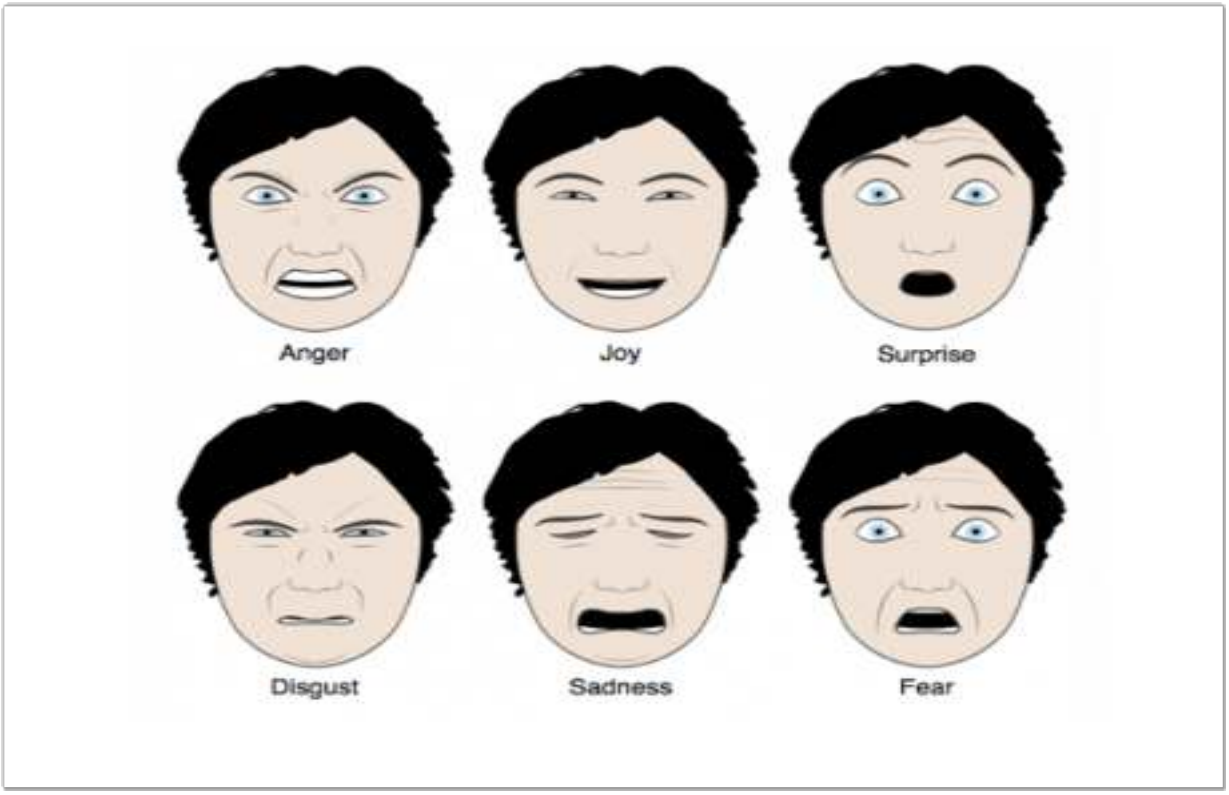

Figure 4.6.Facial expressions

4.1.3 Effective communication

Effective communication is about more than just exchanging information. It's about understanding the emotion and intentions behind the information. As well as being able to clearly convey a message, you need to also listen in a way that gains the full meaning of what's being said and makes the other person feel heard and understood.

Effective communication is important for people to communicate with others while expressing their needs and understanding the tasks or duties given to them. Good communication skills may also be important in certain industries, including sales, as it helps people understand the needs of a customer before then expressing value to them. Some examples of effective communication skills may include;.

- Active listening
- Nonverbal communication
- Questioning
- Problem-solving
- Decision-making
- Clarity
- Confidence
- Empathy and compassion

- Respect
- Feedback

- **Importance of effective communication**

✓ **Demonstrates understanding**

Learning to communicate effectively can help you demonstrate an understanding of what the other person is saying. Whether you're communicating with a coworker or manager, effective communication can help teams improve productivity and work towards a common goal.

✓ **Helps to prevent conflict**

Effective communicators have the skills necessary to prevent or resolve conflict. This can help teams overcome challenges or barriers to productivity and progress toward the completion of projects faster, while also improving employee morale.

✓ **Improves engagement**

Creating teams of effective communicators can also increase employee engagement among team members. This is especially useful as a leader when encouraging team members to work together.

✓ **Solves problems**

Effective communication skills can help team members identify solutions to common problems. Good communication skills also make it easier for team members to articulate and clearly express their current concerns, leading to a more transparent and honest work environment.

✓ **Builds trust**

Effective communication skills, including empathy, compassion and consistent nonverbal communication patterns can help team members build trust among each other. It can also help leaders earn the respect and trust of their team members.

- **Elements of effective communication**

Effective communication includes a few key elements, including

✓ **Engagement**

Effective communicators can demonstrate their engagement in the conversation. They may show engagement through verbal or nonverbal cues that demonstrate active listening. Another important part of engagement is encouraging the speaker to continue or encouraging them to respond.

- ✓ **Focus**

Effective communicators focus on the speaker, making them feel heard and understood. In addition to listening to the words the speaker is communicating, an effective communicator also pays attention to nonverbal cues such as body language and intonations. If you're the speaker, focusing on the nonverbal communication of listeners can help you understand their interest in the topic you're discussing.

- ✓ **Consistency**

Consistency is important when communicating with others, as it allows them to understand and gauge the direction of the conversation. Effective communicators can maintain consistency across various topics of communication.

- ✓ **Value**

An effective communicator provides value to those they're communicating with. Communication is a two-way process and for it to be effective, all communicators can provide value to the others involved in the conversation. Learning skills in questioning, including forming valuable questions and identifying a purpose, can also help improve the value that you offer in a conversation.

- ✓ **Emotionalmanagement**

Managing emotions is another element of effective communication. The ability to understand how one's emotions influence a conversation can help speakers better controls them. Emotional intelligence can help speakers further their communication skills, specifically when it comes to the ability to effectively communicate.

- ✓ **Clarity**

Effective communication involves clarity. Before speaking, it can be helpful to first identify your purpose and how best to express it. When listening to someone, identify and summarize what the speaker says to demonstrate your understanding. If you're unsure, you can always ask questions or paraphrase to gain further clarity.

https://www.youtube.com/watch?v=6pYSbdGiDYw

https://www.youtube.com/watch?v=slq1nAhZuqE

4.2 Making appropriate contributions to complement team activities

4.2.1 Effective contributions to teams

The success of a project is largely down to its management. There needs to be a project manager who keeps things on track and ensures that tasks are completed on time and to the appropriate quality.

Individual team members contribute to the achievement of the project's objectives. Typically, this involves creating the deliverables and providing insight or knowledge based on their area of expertise.To contribute effectively to a project, no matter what level you are at, you need to be able to do the following

- **Understand the Project's Objectives**

What has the project been set up to achieve? Where are we going and why? If the end-goal is not known or recognized, then the team may find it difficult to focus their efforts or understand the role that their contribution is making to the wider goal.

- **Recognize your own role**

Everyone in a project needs a clearly defined role. All team members need to understand what their own role is and the roles of those around them. The interdependencies of the project activities must also be understood so that individuals see their roles in the wider context, rather than in isolation.

- **Be willing to work with others**

Project work involves collaboration and working with other people. If issues emerge, team members need to feel confident in raising them. People should not feel afraid to offer ideas or alternative approaches where relevant.

- **Have a critical mind**

Asking effective questions and approaching tasks with a critical and enquiring mind is crucial. Too often, assumptions can creep into projects that might lead to things being overlooked.

- **Learn from Lessons**

A diverse project team will bring insights and perspectives from a range of situations, which means that having a collaborative ethos is a must. The team members should use their collective

experience to look at went right or wrong with previous projects and how these lessons can be applied to the current situation.

4.3 Observing protocols using standard operating procedures

4.3.1 Standard operating procedures

SOP is a document guides new as well as current employees on how to carry out routine tasks and maintain consistency and quality throughout business operations. Since SOPs are crucial documents, we decided to uncover everything there's to know about standard operating procedures and provide you a tool to create SOPs with ease.

- **Types of Standard Operating Procedures (SOP)**

While you can write your standard operating procedures according to your organizational needs, a conventional SOP follows one of the following methods:

- ✓ **Checklists**

A checklist or the to-do list is one of the simplest methods of writing a standard operating procedures (SOP) document. A checklist can be created on an online note-taking app like Bit or can be printed out and handed over to employees.Checklists are the easiest to create as you can simply create a header and add relevant checklist items that employees need to follow in order to complete the task.

- ✓ **Step-by-Step List**

Similar to checklists, a step-by-step bullet list works in the same way where you describe a procedure in relevant, easy-to-follow steps.

- ✓ **Hierarchical Lists**

If your procedures are more complex and need additional info, you can create hierarchical checklists or bullet lists. If you are unable to explain a task in a single step and at the same time, don't want to make the SOP lengthy, adding hierarchical steps can be beneficial.

- ✓ **Process Flowchart**

Flowcharts are a wonderful way to represent how a process works visually and help give better context around the workflow.

4.3.2 The need of Standard Operating Procedures (SOP)

- **Time-saving**

Even though creating SOPs can be time-consuming, they end up saving you a ton of time in the long run.If all employees perform the same task in different ways, some are going to do it faster

while others might take a long time. Having rules and guidelines in place streamlines the workflow, ensuring employees do the task in a set amount of time.

- **Ensure the safety of employees**

Standard operating procedures (SOP) make sure that employees perform all tasks and activities in a consistent yet safe manner. This puts the business in a tough situation and opens it up for lawsuits and liabilities.

- **Ensures compliance standards are met**

Having standard operating procedures in place ensures that industry compliance standards are followed and met properly. SOPs put measures in place so that employees comply with relevant laws, policies, and regulations, and avoid any sort of litigation or risk.

- **Improved communication**

Communication is key in business. Still, a whopping 57% of employees report not being given clear directions and 69% of managers' report they are not comfortable communicating with the employees in general. Standard operating procedures make your manager's job easier as they don't have to communicate the policies and procedures to each and every employee individually.

- **Enhanced accountability**

Having standard operating procedures (SOP) in place helps managers gouge employee performance based on the guidelines provided by them.Without proper work standards, understanding employee performance becomes a matter of personal opinion, which is far from being the right way to judge your employee's hard work.

- **Provides consistency**

SOPs provide consistency of operations and ensure a smooth workflow. All employees have the same document which they can go through and know exactly what needs to be done and how. This leads to consistent performance with fewer resources wasted.

- **Maintains organizational knowledge**

Even if your team can perform all necessary tasks with ease, consistently, and without any external aid or documentation, you still need to create an SOP document.

- **Provides a guiding hand**

Standard operating procedures act as a true north for the employees, guiding them in their journey to do amazing work.

4.3.3 Protocols SOP Document

The following structural elements are commonly found in most standard operating procedures (SOP) out there:

- **Title Page:** Kickoff your SOP with the title of the procedure, the unique SOP identification number, date of creation or revision, the department/employees/team the SOP applies to, and finally the name and signatures of the parties involved in creating the SOP document.
- **Table of Contents:** Next up is a table of contents. A table of contents helps summarize the document structure and acts as a guide for the reader to quickly jump to sections relevant to him/her.
- **Purpose:** Describe the goals and objectives of creating the document and how it will benefit the user and the organization.
- **Scope:** Project scope describes the limits of the document and helps the reader understand the boundaries of the SOP.
- **Glossary:** It's helpful to include words, abbreviations, or acronyms you may have used in the document that may not be familiar to your audience.
- **Roles and Responsibilities:** Identify key stakeholders (employees, managers) who have to follow this SOP and what responsibilities they would have.
- **Procedures:** This will form the bulk of your SOP document as this section will describe the step-by-step explanations of how to perform tasks and any additional information needed to complete the tasks.
- **Related Documents:** Include a list of related training materials or reference guides to your SOP.
- **Health and safety warnings:** Your SOP should have a separate section describing the things your employees need to avoid and perform the operations in a safe environment.
- **Revision History:** Add a revision history to ensure your readers that the SOP they are reading is the latest one.
- **Approval Signatures:** If your company requires an authorizing officer to sign off on SOPs, don't forget to get it approved by them before sharing it with your audience.

4.4 Contribute to the development of team work plans

4.4.1 The team building concept

A team is a group of people working towards a common goal. Team Building involves the process of enabling the group of people to reach their goals. It consists of steps like clarification of team goals; identification of hindrances to goal achievements; facing the identified challenges and enabling the achievement of the goals. Team building is to change the behaviors and attitudes prevalent in the organization, which are almost independent of who actually works there. Team building doesn't just mean getting the team together.

4.4.2 Team building objectives

Team building objectives are wider results leaders hope to achieve by implementing a team building program and typically apply on an organizational level, while team building goals are immediate outcomes desired from these activities and are usually team-specific.

Team building has several major objectives one of which is enhancing good communications with participants as team members and individuals. There is also increased productivity and creativity. Another objective of team building is to achieve better operating policies and procedures thereby motivating team members to achieve goals. It is also aimed at ensuring clear work objectives and a climate of cooperation and collaborative problem-solving.

4.4.3 Team development stages

- ✓ **Forming**

This is where team members first meet. It’s important for team leaders to facilitate the introductions and highlight each person’s skills and background.

- ✓ **Storming**

At this stage, team members openly share ideas and use this as an opportunity to stand out and be accepted by their peers. Team leaders help teams in this stage by having a plan in place to manage competition among team members, make communication easier, and make sure projects stay on track.

✓ **Norming**

By now, teams have figured out how to work together. There's no more internal competition, and responsibilities and goals are clear. Each person works more efficiently because he or she has learned how to share their ideas and listen to feedback while working toward a common goal.

✓ **Performing**

There's a high level of cohesion and trust between team members. Teams are functioning at peak efficiency with less oversight from team leaders. Issues still come up, but at this point, teams have strategies for resolving problems without compromising timelines and progress.

✓ **Adjourning**

Teams complete their project and debrief on what went well and what could be improved for future projects. Afterwards, team members move on to new projects. Now let's look at how to use this model to amplify the strengths within your remote marketing team so that projects are successful and completed on time.

Figure 4.7. Team development stages

https://youtu.be/mQS3KFODhv4 (Access date 11/26/2022)

Self-check 4	Written test

Name:……ID:…… Date ……..:

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

Part **1: choose the best answer(4 points)**

1 In which types of communication is two persons are involved in this communication process

A. Dynamic communication

B. Interpersonal communication

C. Small group communication

D. Public communication

2. Which one of the following is a non-verbal communication method?

A. Body language

B. Touch

C. Gestures

D. All

Part 2: Give short answer (6points)

1. List the stage of team development?
2 Describe the protocols should be incorporate in SOP document contents?
3 Write the types of SOP?
4 Write the elements of effective communication?

Note: Satisfactory rating – 5 points Unsatisfactory – below 5 points

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

LG #5	LO 5 Operate and Monitor the Waste Water Treatment Process

Instruction sheet-5

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

- Identifying and reporting health and safety hazards requirements procedures
- Starting up waste water system
- Operating plant
- monitoring equipment operating condition
- monitoring, testing and adjusting waste water quality
- Operating first flush system during rainfall events
- Meet work place housekeeping standard

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:

- Identify and report health and safety hazards requirements procedures
- Startup waste water system
- Operate plant
- Monitor equipment operating condition
- Monitor, test and adjust waste water quality
- Operate first flush system during rainfall events
- Meet work place housekeeping standard.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks
5. Perform Operation Sheets
6. Do the “LAP test”

Information Sheet-5

5.1. Identifying and reporting health and safety hazards requirements procedures

5.1.1. Identifying and reporting hazards

'Hazard' is defined as an agent or condition of an activity that has the potential to cause an adverse health effect in humans. Hazards in dairy wastewater treatment process include;

a. **Biological Hazards** which are Microorganisms or pathogens those can degrade the organic materials in the wastewater.

b. **Chemical**

Water can become contaminated with unwanted chemicals such as cleaning agents and processing additives. There should be proper handling of chemicals, and flammable gases in order to minimize chemical hazards.

c. **Physical hazard**

Water can be contaminated with physical objects such as glass, metal, plastic, insects, and adhesive dressings and jewelers. If these things are found in water, they may introduce microbial hazards and may also result in physical harm to the worker.

Dairy processing plant is best ensured through the identification and control of hazards in the production, manufacturing and handling of processing inputs as described in the Hazard Analysis and Critical Control Point (HACCP) system. Hazard Analysis Critical Control point System is a way of ensuring that food is safe.

Safe work procedure including awareness of health and safety hazards related to waste water system operation and associated control measures can prevent or minimize hazards.

Report health and safety hazards to appropriate person which includes;

- Waste water treatment plant breakdown
- Waste water treatment storage area problem
- Useless/expired waste treatment chemicals
- Outcome of the operation
- Obstacles of the treatment operation

5.1.2. Types of pollutants in dairy waste waters

The food industry contributes to a great extent to pollution; these pollutants are of organic and inorganic matters.

a. Organic pollutants

The normal way to express the concentration of a pollutant is to specify the total quantity per unit volume of sewage. However, the quantity of organic substances is normally determined in the form of;

- Biological oxygen demand (BOD)
- Chemical oxygen demand (COD)
- Calcining loss
- Total organic carbon (TOC)

i. **Biological oxygen demand:** BOD is a measure of the content of biologically degradable substances in sewage. The substances are broken down by micro-organisms in the presence of oxygen. It is measured in mg oxygen/l or g oxygen/m3.

ii. **Chemical oxygen demand**: COD indicates the quantity of the pollutants in wastewater that can be oxidized by a chemical oxidant. The normal reagents used for this purpose are strongly acid solutions of potassium dichromate or potassium permanganate at high temperature. It is measured in mg oxygen/l or g oxygen/m3.

iii. **Calcining loss:** it is obtained by first determining the dry solids content in a sample, and then Calcining it so that the organic substance is burnt. The difference in weight before and after Calcining represents the quantity of organic substance. The value is expressed in %.

iv. **Total Organic Carbon**: it is another measure of the quantity of organic materials, determined by measuring the quantity of carbon dioxide produced from combustion of a sample. The unit is mg/l.

b. Inorganic pollutants: The inorganic components of sewage consist almost entirely of salts, and are determined largely by the ionic composition and salt concentration in the mains water. The presence of these salts in sewage is normally unimportant.

Present-day effluent treatment processes concentrate on the reduction of nitrogen, phosphorus, salts and heavy metals. Nitrogen and phosphorus compounds are important, as they are nutrients for organisms, e.g. algae, in recipients.

5.2. Starting up waste water system

5.2.1. Wastewater treatment

Wastewater treatmentis a process with a series of designed unit operations and processes that aims at reducing certain constituents of wastewater to acceptable levels.

Wastewater treatment is vital for the:

- Reduction of biodegradable organic substances in the environment
- Reduction of nutrient concentration in the environment.
- Elimination of pathogens /micro-organism
- Recycling and reuse of water.

5.2.2. Waste water treatment systems

Due to the nature of contaminants in wastewater, unit operations can be;

a. Physical unit operations

- Screening
- Comminution
- Flow equalization
- Sedimentation
- Flotation
- Granular-medium filtration

b. Chemical unit operations

- Chemical precipitation
- Adsorption
- Disinfection
- Dechlorination

c. Biological unit operations

- Activated sludge process
- Aerated lagoon
- Trickling filters
- Rotating biological contactors
- Pond stabilization
- Anaerobic digestion

5.2.3. Levels of wastewater treatment

There are three broad levels of treatment:

- Primary treatment / Mechanical
- Secondary treatment / Biological
- Tertiary treatment / Chemical sedimentation

a. Preliminary and primary treatment

Sometimes, preliminary treatment precedes primary treatment.

- ✓ **Preliminary treatment** consists only in separating the floating materials (like dead animals, tree branches, papers, pieces of rags, wood, etc.), and also the heavy settleable inorganic solids. It also helps in removing the oils and greases, etc. from the sewage. This treatment reduces the BOD of the wastewater, by about 15 to 30%.
- ✓ **Primary treatment** removes settle able organic and inorganic solids by sedimentation and floating materials (scum) by skimming. Up to 50% of BOD5, 70% of suspended solids and 65% of grease and oil can be removed at this stage. The effluent from primary sedimentation units is referred to as primary effluent.
- ✓ **The Preliminary and primary treatment processes** used;
  - ➢ Screening
  - ➢ Grit chambers or Detritus tanks
  - ➢ Skimming tanks for removing oils and greases

i. Screening

Screening is the very first operation carried out at a sewage treatment plant, and consists of passing the sewage through different types of screens, so as to trap and remove the floating matter, such as pieces of cloth, paper, wood, cork, hair, fiber, kitchen refuse, fecal solids, etc. present in sewage.

Depending upon the size of the openings, screens may be classified as;

Coarse screens are also known as Racks, and the spacing between the opening sizes is about 50 mm or more. These screens do help in removing large floating objects from sewage.

In medium screens, the spacing between bars is about 6 to 40 mm. These screens will ordinarily collect 30 to 90 liters of material per million liter of sewage.

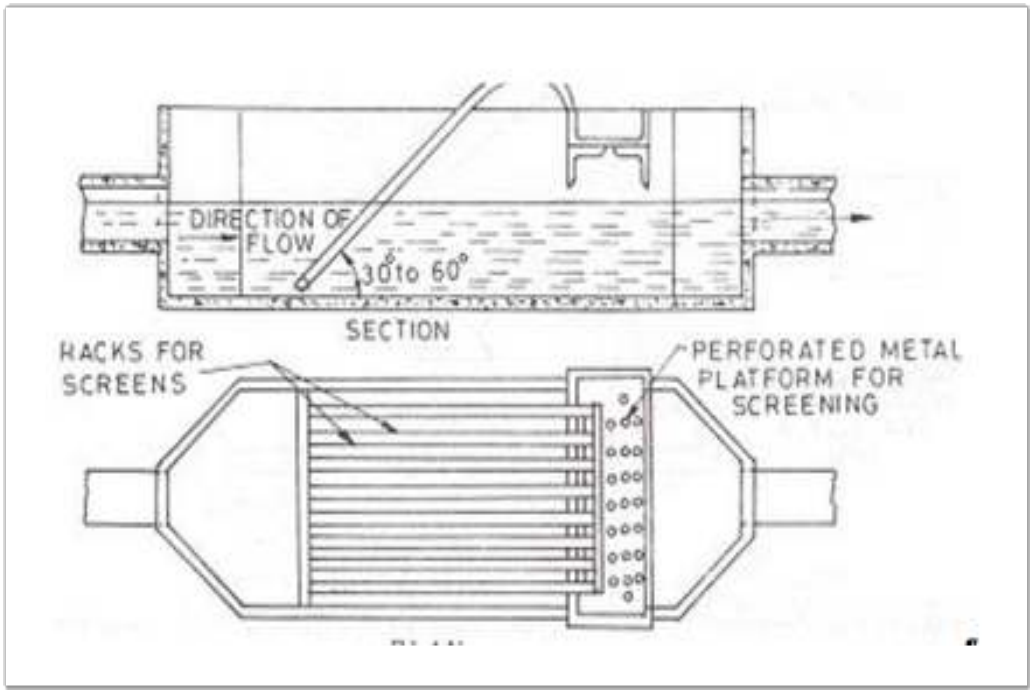

Figure 5.1. Fixed bar type coarse or medium screen

Fine Screenshave holes of 1.5 mm to 3 mm in size. The installation of these screens proves very effective, and they remove as much as 20% of the suspended solids from sewage. These screens, however, get clogged very often, and need frequent cleaning. These screens will considerably reduce the load on further treatment units.

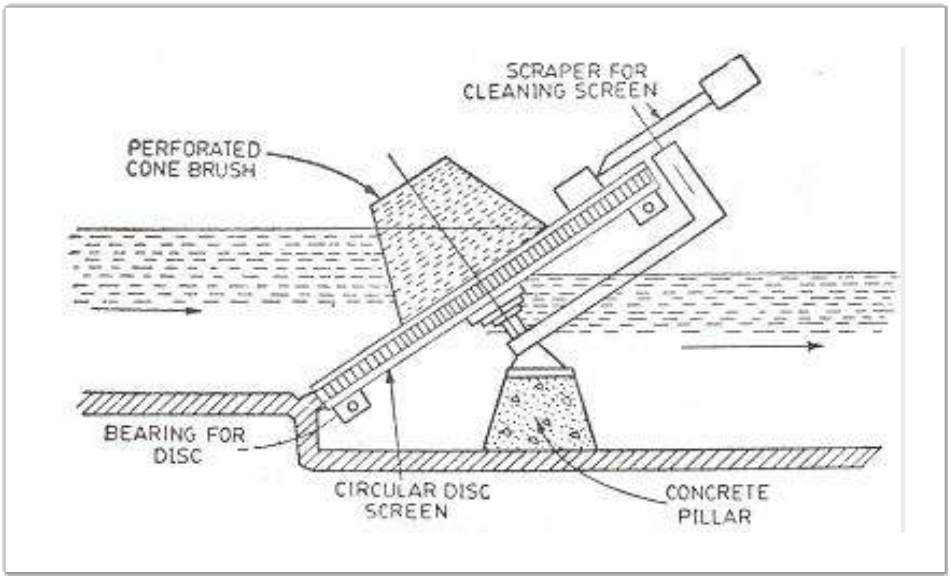

Figure 5 2. Reinsch-Wurl screen (disc type fine screen)

Comminutors

Comminutors or Shredders are the patented devices, which break the larger sewage solids to about 6mm in size, when the sewage is screened through them. Such a device consists of a revolving slotted drum, through which the sewage is screened

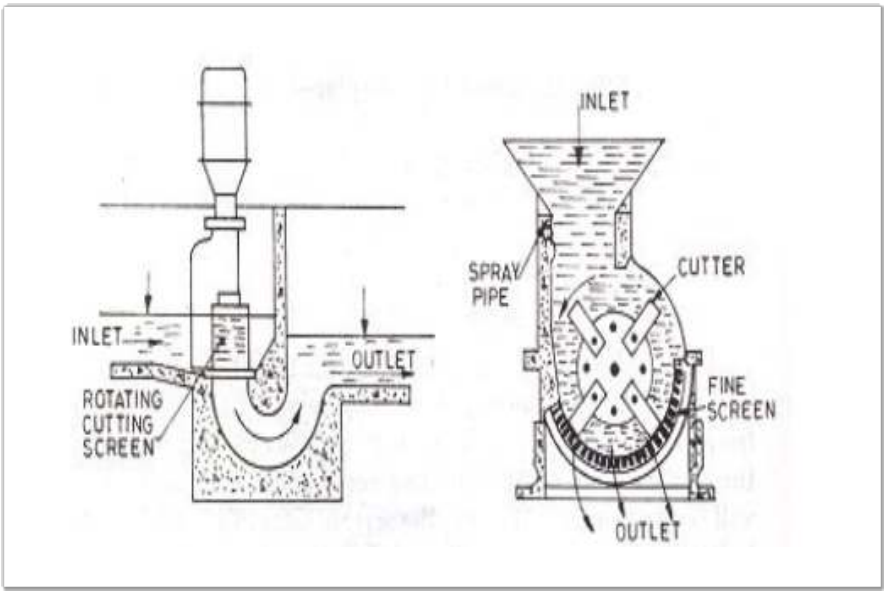

Figure 5.3. Comminutor or shredder

Disposal of Screenings

The material separated by screens is called the screenings. It contains 85 to 90% of moisture and other floating matter. To avoid such possibilities, the screenings are disposed of either by burning, or by burial, or by dumping.

i. Grit Chambers or Detritus Tanks

Detritus tanks are nothing but rectangular grit chambers, designed to flow with a smaller flow velocity (of about 0.09m/sec) and longer detention periods (about 3 to 4 minutes) so as to separate out not only the larger grit, etc., but also to separate out the very fine sand particles, etc. for removing grit and sand.

ii. Skimming /Tanks for removing Oils and Grease/

Skimming tanks are employed for removing oils and grease from the sewage, and placed before the sedimentation tanks. They used where sewage contains too much of grease or oils which include fats, soaps, fatty acids, etc.

- **Disposal of Skimming**

The oil and greasy material removed as slimmings from the skimming tanks can be disposed of either by burning or burial. It is generally too polluted to be of any economic use.

Generally, Primary treatment consists in removing large suspended organic solids. This is usually accomplished by sedimentation in settling basins. Sometimes, the preliminary as well as primary treatments are classified together, under primary treatment.

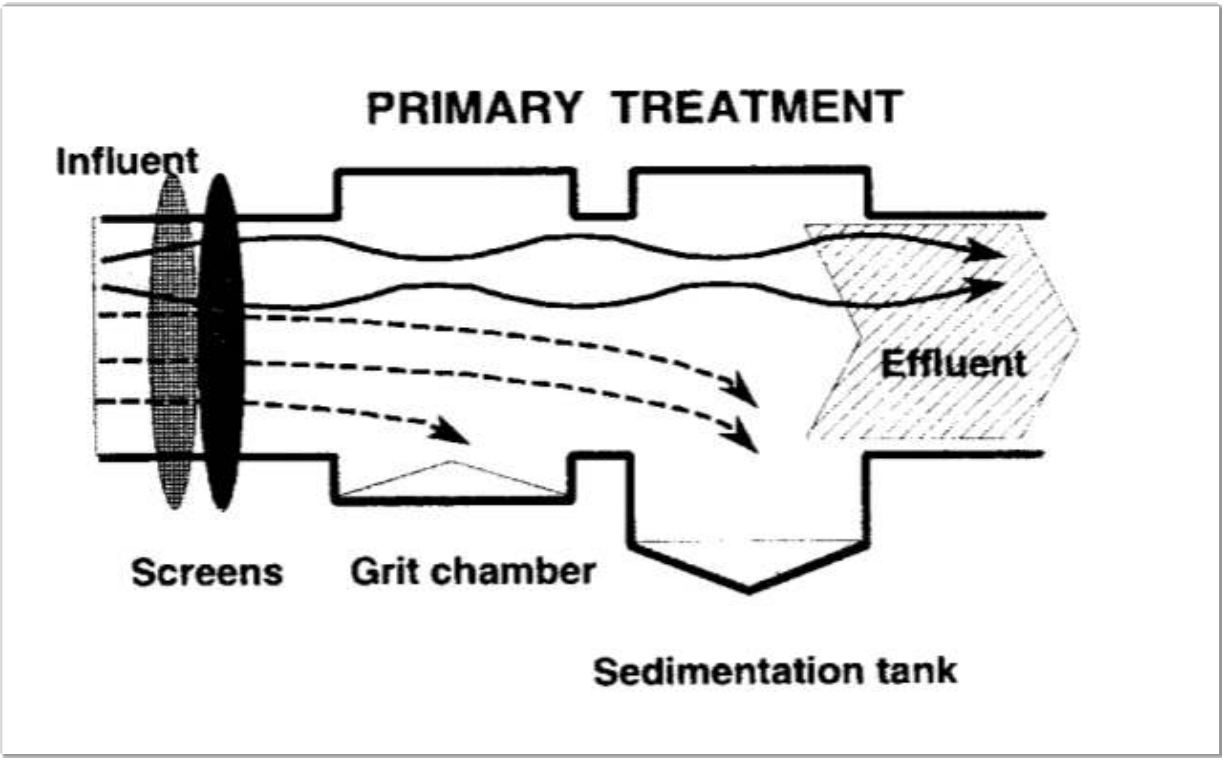

Figure 5.4. Primary Treatment

b. Secondary wastewater treatment

The secondary stage of treatment is the further treatment of primary effluent to remove residual organics and suspended solids and it removes about 85% of the organic matter in sewage by making use of the bacteria in it.

5.2.4. Waste treatment Ponds

These ponds used to achieve secondary (biological) treatment without all of the mechanical equipment and treatment units associated with the activated sludge process.

There are different types of treatment Ponds.

i. **Aerobic ponds:** shallow pond designed to treat wastewater under aerobic conditions.
ii. **Anaerobic ponds:** shallow pond designed to operate in the absence of dissolved oxygen.
iii. **Facultative ponds:** Combines aerobic and anaerobic treatment. Aerobic treatment occurs in the upper portion of the pond where oxygen is available from photosynthesis and absorption at the water/air interface

iv. **Aerated Ponds**: Similar to Facultative pond, except deeper, ranging in depth to 20 feet. Aerobic treatment occurs in upper portions of pond. Extended depth provided to allow for long-term storage of settled solids.

Pond Location

Ponds should be located at least 200m (preferably 500m) downwind from the community they serve and away from any Likely area of future expansion. Odour release, even from anaerobic ponds, is most unlikely to be a problem in a well-designed and properly maintained system, but the public May need assurance about this at the planning stage, and a minimum distance of 200 m normally allays any fears.

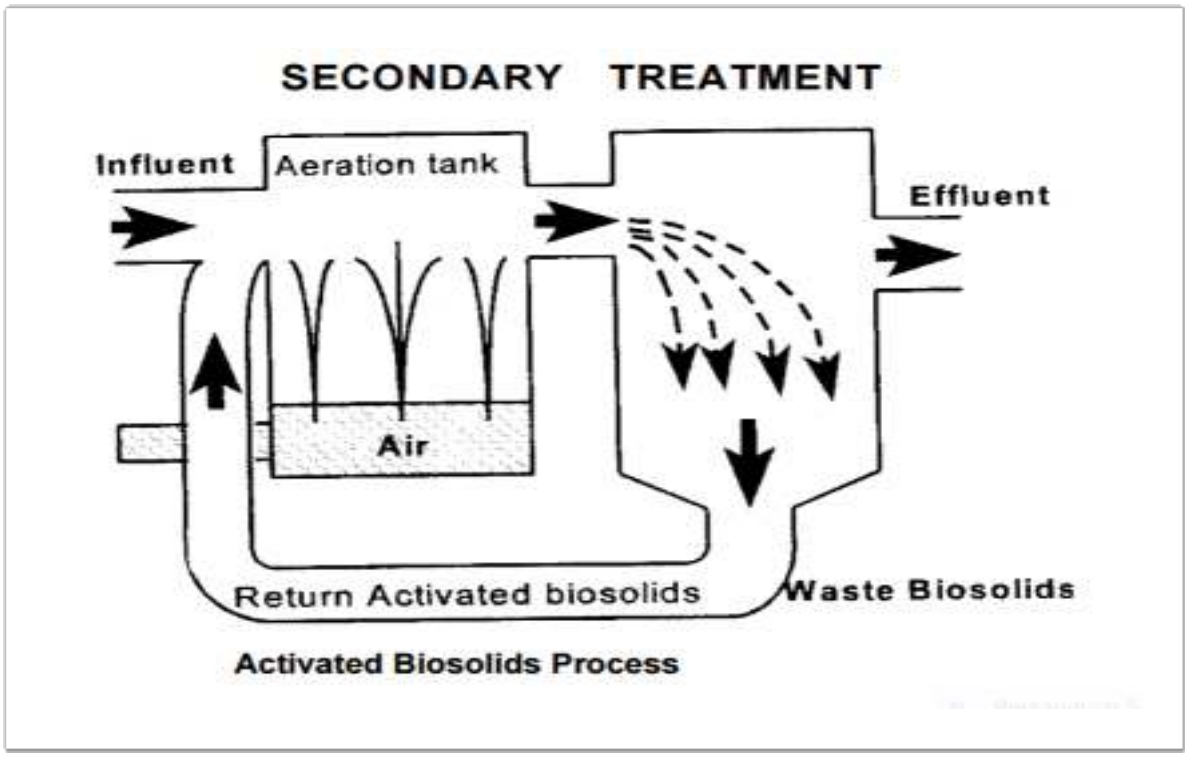

Figure 5.5.Secondary wastewater treatments

c. Tertiary wastewater treatment processes

This is an advance treatment employed when specific wastewater constituents which cannot be removed by secondary treatment must be removed. Advance treatment removes significant amounts of nitrogen, phosphorus, heavy metals, biodegradable organics, bacteria and viruses.

- **Tertiary wastewater treatment processes**
  - ✓ Filtration

- ✓ Lagooning/ further biological ponds
- ✓ Nutrient removal
- ✓ Nitrogen removal
- ✓ Phosphorus removal
- ✓ Disinfection
- ✓ Odour Control

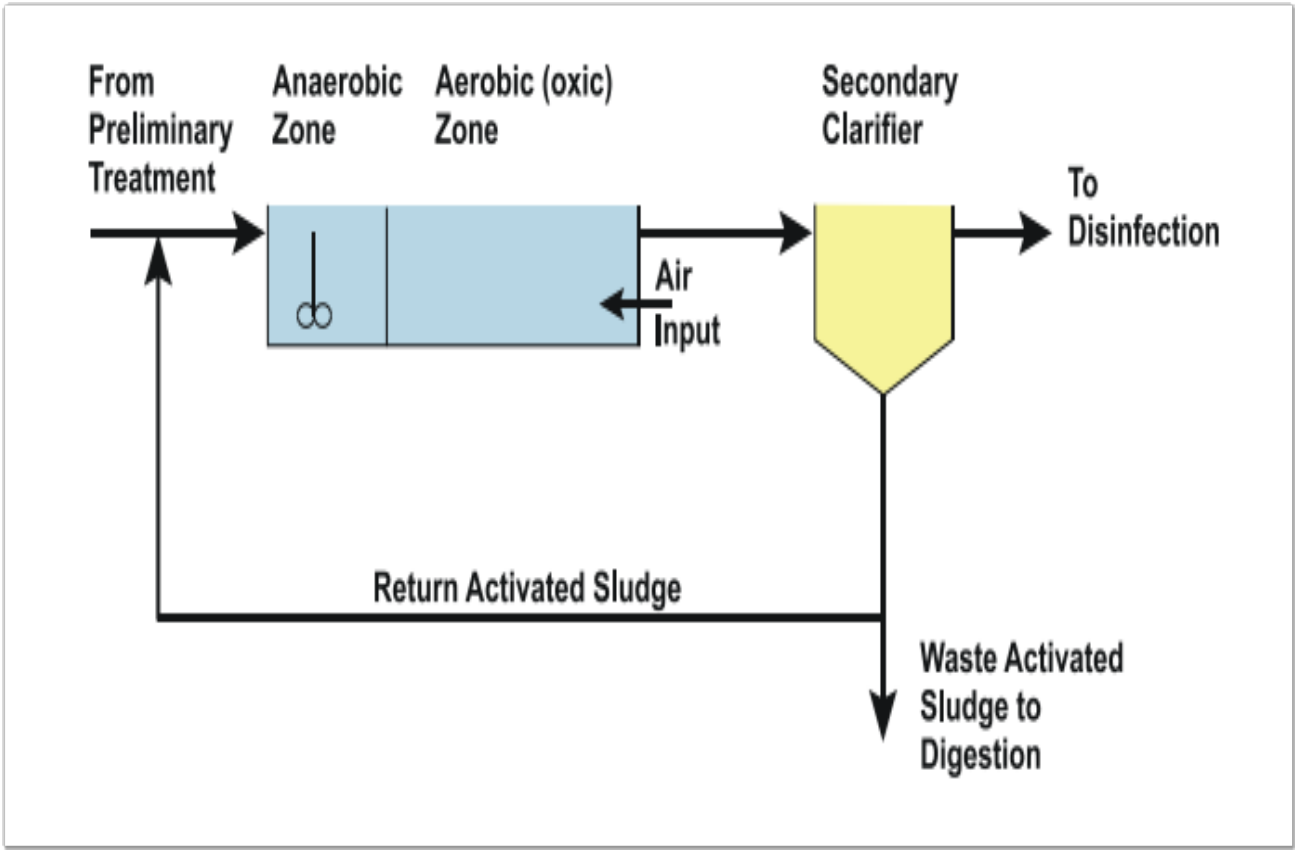

Figure 5.6. Biological phosphorus removal process schematic

https://www.youtube.com/watch?v=s8IVjQg7yno (access Nov 25/2022)Waste water treatment stage

5.3. Operate plant

5.3.1. Operating plant within limits of manufacturer's specification

Wastewater Treatment Plant is a plant with a series of designed unit operations and processes that aims at reducing certain constituents of wastewater to acceptable levels.

1. Operations of the treatment plant

During plant operation activity, there will be normal or abnormal operation.

- Normal operations are when processes are functioning properly.
- Abnormal operations are when a process is not working properly, or when equipment is not available and this required corrective action.

Wastewater treatment processing activities such as plant cleaning, material conveying, bottling, and product washing create wastewater. Many food processing facilities require on-site treatment before operational wastewater can be land applied or discharged to a waterway or a sewer system. Industrial wastewater treatment describes the processes used for treating wastewater that is produced by industries as an undesirable by-product..

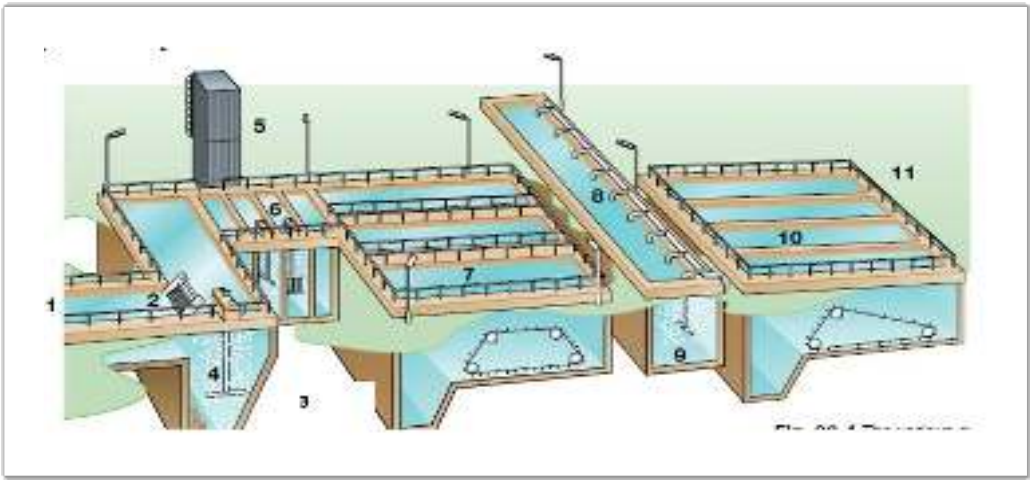

Figure 5.7. Waste water treatment plant

1. Inlet channel
2. Grid
3. Sand trap
4. Aeration
5. Silo for flocculants
6. Pre-precipitation
7. Pre-sedimentation
8. Biological treatment
9. Aeration
10. Post-sedimentation

5.4. Monitoring equipment operating condition

5.4.1. Monitoring waste water treatment equipment

Monitoring is the systematic process collecting, analyzing and using information to track a process progress toward reaching its objectives and to guide waste water treatment equipment management decision. Operation and monitoring of equipment and processes typically requires the use of control panels and systems. The treatment system should be designed so that sampling

of the inflow and- outflow is practicable. The design should also permit easy access to most parts of the treatment system.

Monitoring requirements include stem in flow and final wastewater flows, suspended solids concentrations and substrate concentrations. Operational monitoring generally includes Rotating Biological Chambers/RBC basin dissolved oxygen (DO) levels, pH, sludge settle ability, sludge flow from secondary to primary settlement tank and sludge wasting rate. If the RBC is overloaded, there will be odor problems at the inlet end of the biological zone. Monitoring requirements may include' stem inflow and wastewater flows, suspended solids Concentrations and substrate concentrations.

5.5. Monitoring, testing and adjusting waste water quality

5.5.1. Monitoring waste water quality

Wastewater quality monitoring is commonly is a process of taking a sample and analysis of water in wastewater treatment operation. Waste water quality monitoring can evaluate the physical, chemical, and biological characteristics of water. Monitoring requirements may include system inflow and final wastewater flows, suspended solids Concentrations and substrate concentrations.

- **Waste water quality**

Water quality sampling and test procedures including the purpose of test and safe use care and storage of relevant test equipment, interpretation and recording of results.

The objective of wastewater quality monitoring is to obtain quantitative information on the physical, chemical, and biological characteristics of water via statistical sampling.

- **Wastewater quality indicators include**;
  - ✓ Temperature and dissolved oxygen.
  - ✓ Conventional variables (pH, TDS, conductivity, and suspended sediment)
  - ✓ Organic Nutrients.
  - ✓ Presence of metals.
  - ✓ Hydrocarbons.

- ✓ Chemicals and minerals

Ways to testing and monitoring the wastewater quality, encouraging a clean and healthy aquatic ecosystem include;

- Chlorophyll Fluorescence Analysis.
- Conductivity, Salinity, and TDS Monitoring.
- Recording the water temperature.
- Measuring the DO levels.
- PH testing.

5.5.2. waste water quality Test

A. Physical properties

Physical property of wastewater testing includes measuring temperature, pH, conductivity (salinity) and turbidity. Color and odor are characterized as well. For instance, a too high or too low pH in wastewater can affect the aquatic lives in receiving water as they only live in neutral or slightly basic water environment.

Figure 5.8. . Physical properties

B. Solids

Solids include dissolved, suspended, and settled solids. Total suspended solids (TSS), for instance, allows water to absorb more light, and therefore increases water temperature and reduces dissolved oxygen. This eventually negatively impacts or even kills aquatic animals. Total dissolved solids (TDS) on the other hand contain high concentrations of salts (chloride,

sulfate, calcium and magnesium), and receiving water containing high TDS is not suitable for irrigation and industrial reuse.

Figure 5.9. Solid test

C. Biological measurements

Biological measurements include bioassays and coliform measurements. Bioassays help understand wastewater contaminants' harmful effects on living organisms (plants and animals) or cells. Coliform index gives indicators on the presence of possible intestine pathogens.

Figure 5.10. Biological measurements

D. Organic tests

Aquatic animals require dissolved oxygen (DO) in water to live. Aerobic bacteria can degrade organic matters using dissolved oxygen in water and BOD measures the amount of oxygen used up by bacteria for degrading organic matter. BOD is an indicator for the amount of organic

materials in the wastewater effluent. The goal of the wastewater treatment is to reduce the BOD value in wastewater.

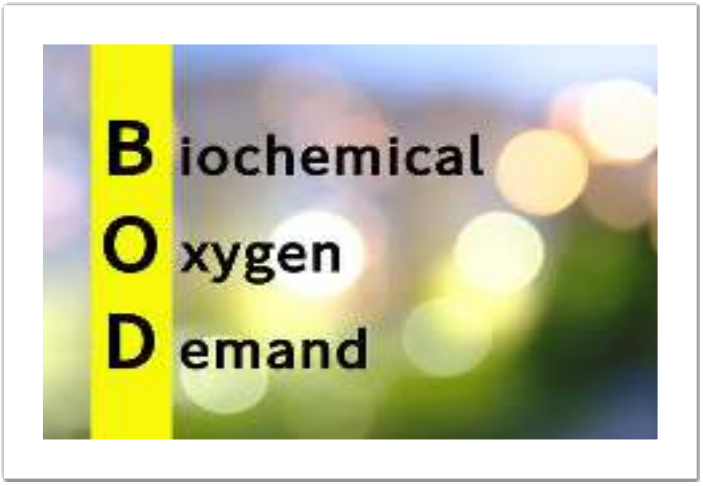

Figure 5.11. Organic test

E. Nutrient tests

Wastewater from agriculture, animal feeding, storm water runoff and municipal facilities may all contribute to the blame of algal blooming due to excess amount of nutrients in surface water. The overgrowth of algae using excess amounts of nitrogen (from ammonia, nitrite, nitrate and organic nitrogen) and phosphorus in surface water causes production of neutoxins (microcystins) that may contaminate future drinking water and threaten human health.

Figure 5.12. Nutrient tests

F. Metal tests

The major source of heavy metal contamination is industrial wastewater from textile, paper and pulping, semi-conductor, metal finishing and plating, and many other industrial categories.

Figure 5.5.6. Metal tests

G. Organic contaminants and emerging contaminants test

Last, but not least, are organic contaminants and emerging contaminants. Many different kinds of organic contaminants including pesticides in wastewater are regulated in NPDES (National Pollutant Discharge Elimination System) permits.

https://www.youtube.com/watch?v=kZH9PFI5Dl4Waste water quality testing steps

5.6. Operating first flush system during rainfall events

First flush is the initial surface of runoff the rainstorm. During this phase, water pollution entering storm drains in areas with high proportions of impervious surface is typically more concentrated compared to the reminder of the storm. Consequently, these high concentrations of urban runoff result in high levels of pollutants discharged from storm sewers to surface waters.

First flush device is one that takes the first water from the roof and diverts it to the tank. If it important to flush the roof and divert water from your tank, because over time your roof gets dust and dirt and debris from the environment.The term is often also used to address the first flood after a dry period, which is supposed to contain higher concentrations than a subsequent one. This is referred to as "first flush flood."

There are various definitions of the first flush phenomenon.
Primary treatment consists of temporarily holding the sewage in a quiescent basin where heavy solids can settle to the bottom while oil, grease and lighter solids float to the surface. The settled and floating materials are removed and the remaining liquid may be discharged or subjected to secondary treatment.

The major aim of waste water before releasing wastewater treatment is to remove as much of the suspended solids as possible before the remaining water, called effluent, is discharged back to the environment.. Primary treatment removes material that will either float or readily settle out by gravity. It includes the physical processes of screening, commination, grit removal, and sedimentation. Screens are made of long, closely spaced, narrow metal bars.

5.7. Meet work place housekeeping standard

Effective housekeeping can help to prevent or minimize workplace hazards. It includes keeping work areas neat and orderly, maintaining halls and floors free of slip and trip hazards, and removing of waste materials and other fire hazards from work areas. Good housekeeping practices help ensure neat, organized, and safe workspaces, which can reduce stress and improve morale.

5.7.1. Good housekeeping Practice in the workplace includes;

- Properly drain wastewater to the store tank.
- Ensure all spills are immediately cleaned up.
- Keep walkways and stairways clear.
- Regularly inspect, clean and repair all tools.
- Apply Kaizen to the processing plant, etc.

Treated wastewater with high levels of pollutants caused by poor design, operation or treatment systems creates major environmental problems when discharged to surface water or land. Such problems include;

- Contamination and deoxygenation of streams and waterways by direct discharge or run-off of inadequately treated wastewater.
- Excessive concentration of nutrients such as nitrogen and phosphorus in surface and subsurface waters.
- Land degradation and damage to pastures and crops. Long-term damage to soil productivity may arise from;
  - ✓ Excessive nutrient loading
  - ✓ High salinity
  - ✓ Low/high pH
  - ✓ Over-application of wastewater to land, resulting in contaminated groundwater
  - ✓ Soil structure decline due to wastewater with high sodium adsorption ratio
  - ✓ Poor irrigation design

Most site losses come from activities associated with liquid handling and to a lesser extent, with the discharge of air and solid waste. Examples of avoidable losses are;

- Leaking valves, pumps, pipelines or other fittings
- Spills usually happen over a short period but the amount & high concentration of milk or product lost may be a significant increase in the pollution load
- Losses from processing and cleaning during the normal operation of plant and equipment.
- Each dairy processing plant should therefore assess opportunities for reducing waste arising from its operations. As a waste reducing hierarchy, the wastewater from dairy processing plant operation can be reducing through;
  - ✓ Reduce
  - ✓ Reuse
  - ✓ Recycle
  - ✓ Treatment
  - ✓ Dispose safely

Self-Check -5	Written test

Name…… ID…… Date…….

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

Part I: Choose the correct answer (4point)

1. Which of the following is under is the organic pollutant and occurs break down by micro-organisms in the presence of oxygen.

A. Biological oxygen demand (BOD) B. Chemical oxygen demand (COD)

C. Calcining loss D. Total organic carbon (TOC)

2. Which one of the following objectives of starting waste water treatment system?

A. Reduction of biodegradable organic substances B. Reduction of nutrient concentration

C. Elimination of pathogens D. All

2. Which one of the following includes operational monitoring of treatment equipment?

A. pH sludge settles ability B. Sludge flow from secondary to primary settlement tank

C. Dissolved Oxygen D. All

3. Which one of the following is water quality indicator?

A. Temperature and dissolved oxygen B. Conventional variables Organic Nutrients.

C. Presence of metals. D. All

4. Which one of the following used to encouraging a clean and healthy aquatic ecosystem?

A. Chlorophyll Fluorescence Analysis. B. Conductivity monitoring

C. Salinity monitoring D. TDS Monitoring. E. All

Part II: Short Answer (16point)

1. What is the objective of water quality monitoring explain.
2. Define first flush systems
3. Define the term "first flush effect
4. Explains the different between BOD ,COD and TOC

Note:Satisfactory rating above 10 points unsatisfactory rating below 10 points

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

Operation Sheet -5

5.1 . Operate waste water treatment

A. prepare require tools and equipment

Step 1 Wear appropriate personal protective equipment

Step 2: Prepare chemicals and equipment.

Step 3: Calibrate required chemicals and equipment.

Step 4: Check the equipment or treatment machine

Step 5: Start the waste water treatment system

Step 6: Monitor the equipment

Step 7: Test waste water quality

Step 8: Meet Workplace housekeeping standards

B. Techniques

- Preliminary Treatment. Screening and Pumping
  - ✓ Primary Treatment. Next, the wastewater enters primary settling tanks where the flow of water slows down.
- Secondary Treatment. Aeration and Final Settling. ...
- Disinfection
- Sludge Treatment. ...
- Waste-to-Energy

N.B:

- Conduct the activity in accordance with workplace procedure.
- Properly operate the machine without any damage and hazard on the operator.
- Maintain workplace safety.

LAP Test	Performance Test

Name…… ID…… Date……

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within **2: 00 hour**. The project is expected from each student to do it.

Task-1: perform waste water treatment

LG # 06	LO 6: Analyze and Respond to Abnormal Performance

Instruction sheet-6

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

- Analyzing water condition and plant operating
- Taking corrective actions
- Implementing emergency procedures

Carrying out pre-start checkThis 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**:

- Analyze water condition and plant operating
- Take corrective actions
- Implement emergency procedures

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets.
4. Accomplish the "Self-Checks" which are placed following all information sheets.
5. If you earned a satisfactory evaluation, proceed to "Operation Sheets.
6. Perform "the LAP Test" which is placed following "Operation sheets".
7. If your performance is satisfactory, proceed to the next Learning Guide.

Information Sheet -6

6.1. Analyzing water condition and plant operating

Each unit operation generates dairy waste water like wash water from cleaning of milk cans, process equipment's, tankers, pipelines floors and portions of spilled milk, spoiled milk and milk leakage from milk pumps and pipelines. There are different categories of water such as:

6.1.3. Cooling water

Cooling water is used in various such as cooling tower, water softener, boiler, back washing of filters and air compressor. Normally cooling water doesn't have any pollutants, so it is discharged as such without any treatment into storm water.

6.1.4. Sanitary waste water

The water which is generated from sanitizing process like cleaning of milk cans, tanks and tankers and floor etc. The high volume sanitary waste water includes

- Lot of organic (milk constituent's viz. Proteins, lactose and fat etc.) And inorganic waste (include phosphates- used as deflocculates and emulsifiers in cleaning compounds),
- Chlorine (used in detergents and sanitizing products) and
- Nitrogen components so it is directed to the sewage treatment plant with or without first having being mixed with industrial waste water.

6.1.5. Industrial waste water

Water used for cleaning of equipment (CIP) is called as industrial waste water; the amount and concentration of waste water depend on the type of product, capacity and the design of the processing plants. This type of generated effluent is highly unstable in nature and biodegradable.

6.1.6. Characteristics of dairy waste

The dairy waste is very complex in nature in terms of biodegradability, because it contains easily degradable carbohydrates, mainly lactose and less biodegradable protein and lipids like milk fats. The easily degradable lactose and less degradable fats can be very different in proportion depending on type of operation and product manufactured.

Like ghee process is high lipids containing while cheese is protein and carbohydrates. The characteristics of a dairy effluent contain

- Temperature,
- Color, Ph (5.5-10.5),
- BOD (0.35-1.8 kg),
- COD,
- Dissolved solids,
- Suspended solids,
- Oil and
- Grease

The waste water is normally white in color and usually slightly alkaline in nature and become acidic quite rapidly due to the fermentation of milk sugar to lactic acid. Dairy effluent, in term of BOD varies from 200 to 3500 mg/L, while COD concentration may be in range of 2 to 2.5 mg/L higher than that of BOD. Productions are major sources of BOD in wastewater.

The biochemical oxygen demand (BOD) in milk and cream is greater than 100,000 mg/L and 400,000 mg/L of BOD, respectively. One gram of milk fat has a BOD of 0.89 g, whereas milk protein, lactose, and lactic acid have BOD values of 1.03, 0.65, and 0.63 g, respectively. Normally milk waste constituents are: 1 kg of milk fat=3 kg COD; 1 kg of lactose=1.13 kg COD; 1 kg protein=1.36 kg COD.

6.1.7. Organics (BOD, COD, TOC, O&G)

Analytical tests aimed at establishing the concentration (typically in mg/L or ppm) of organic (i.e., carbon-containing) matter have traditionally been used to determine the relative "strength" of a wastewater sample. Today there are four common laboratory tests used to determine the gross amount of organic matter (i.e., concentrations > 1.0 mg/L) in wastewater:

- BOD (biochemical oxygen demand)
- COD (chemical oxygen demand)
- TOC (total organic carbon)
- O&G (oil and grease)

Wastewater generated by commercial, industrial and institutional facilities is typically referred to as "high-strength" compared to typical household wastewater. Table 6.1 shows the typical concentrations (mg/L) of organics found in untreated domestic wastewater. This table can be

used to understand how non-sanitary process wastewater compares to typical domestic wastewater.

Table 6 .1: Typical concentrations of organics in untreated domestic wastewater

		Typical Concentration		
Constituents	**Unit**	**Low**	**Medium**	**High**
BOD (biochemical oxygen demand)	mg/L	110	190	350
COD (chemical oxygen demand)	mg/L	250	430	800
TOC (total organic carbon)	mg/L	80	140	260
O&G (oil and grease)	mg/L	50	90	100

(Adapted from Metcalf & Eddy, Inc., 2003, Access on 24/112022)

As per the World Health Organization, a limit of less than 5.0 mg/l is ideal for water bodies. At this limit BOD will not cause any harmful impacts on the human body, wastewater sewage must have BOD around 80 mg/L and COD 200 mg/L for discharge.

BOD (biochemical oxygen demand)

BOD is the traditional, most widely used test to establish concentration of organic matter in wastewater samples (i.e., relative strength). BOD is based on the principle that if sufficient oxygen is available, aerobic biological decomposition (i.e., stabilization of organic waste) by microorganisms will continue until all waste is consumed.

The BOD test is also known as "BOD5" since it is based on the accurate measure of DO (dissolved oxygen) at the beginning and end of a five-day period in which the sample is held in dark, incubated conditions (i.e., 20°C or 68°F). The change in DO concentration over five days represents the "oxygen demand" for respiration by the aerobic biological microorganisms in the sample. The five-day completion window is an inherent disadvantage of the test because wastewater treatment system personnel cannot use it to make real-time operational adjustments.

(https://www.youtube.com/watch?v=aMyhmUB4eb8)

In order to calculate the BOD, the laboratory is sampling some waste water, then is diluting it in a BOD incubation bottle. The lab must measure the following data :

D1 = oxygen diluted level in the diluted sample (mg/l)

D2 = oxygen diluted level in the diluted sample (mg/l)

B1 = oxygen diluted level in the dilution water (mg/l)

B2 = oxygen diluted level in the dilution water at (mg/l)

V1 = volume of wastewater sampled for dilution (ml)

V2 = volume of diluted sample (ml)

The BOD at 5 days can be calculated with the following formula :

BOD5 = [(D1-D2)-(B1-B2)f]/P

Where;

f = (V2-V1)/V2

P = V1/V2

BOD Level in mg/liter	Water Quality
1 - 2	**Very Good:** There will not be much organic matter present in the water supply.
3 - 5	**Fair:** Moderately Clean
6 - 9	**Poor:** Somewhat Polluted - Usually indicates that organic matter present and microorganisms are decomposing that waste.
100 or more	**Very Poor:** Very Polluted - Contains organic matter.

Figure 7.1: pictures of BOD level in the solution

https://www.pharmaguideline.com/2013/06/determination-of-biological-oxygen.html

- **BOD testing**

To ensure proper biological activity during the BOD test, a wastewater sample:

- ✓ Must be free of chlorine. If chlorine is present in the sample, a dechlorination chemical (e.g, sodium sulfite) must be added prior to testing.
- ✓ Needs to be in the pH range of 6.5-7.5 S.U. If the sample is outside this range, then acid or base must be added as needed.

- ✓ Needs to have an existing adequate microbiological population. If the microbial population is inadequate or unknown, a "seed" solution of bacteria is added along with an essential nutrient buffer solution that ensures bacteria population vitality.

- Specialized 300 mL BOD bottles designed to allow full filling with no air space and provide an airtight seal are used. The bottles are filled with the sample to be tested or dilution (distilled or deionized) water and various amounts of the wastewater sample are added to reflect different dilutions. At least one bottle is filled only with dilution water as a control or "blank."
- A DO meter is used to measure the initial dissolved oxygen concentration (mg/L) in each bottle, which should be a least 8.0 mg/L. Each bottle in then placed into a dark incubator at 20°C for five days.
- After five days (± 3 hours) the DO meter is used again to measure a final dissolved oxygen concentration (mg/L), which ideally will be a reduction of at least 4.0 mg/L.
- The final DO reading is then subtracted from the initial DO reading and the result is the BOD concentration (mg/L). If the wastewater sample required dilution, the BOD concentration reading is multiplied by the dilution factor.

COD (chemical demand)

COD is the most popular alternative test to BOD for establishing the concentration of organic matter in wastewater samples. The COD test only takes a few hours to complete, giving it a major advantage over the 5-day BOD test. Wastewater treatment system personnel can use COD as an almost real-time operational adjustment parameter. COD can test wastewater that is too toxic for the BOD test.

The COD test should be considered an independent measure of the organic matter in a wastewater sample rather than a substitute for the BOD test. The COD test uses a chemical (potassium dichromate in a 50% sulfuric acid solution) that “oxidizes” both organic (predominate) and inorganic substances in a wastewater sample, which results in a higher COD concentration than BOD concentration for the same wastewater sample since only organic compounds are consumed during BOD testing. The most popular current testing method for COD involves using sealed and heated (i.e., closed reflux) low-range (3-150 ppm) or high-range

(20-1500 ppm) pre-prepared vials that change color from orange to green based on the amount of oxidation and that are read using a laboratory colorimeter

(https://www.youtube.com/watch?v=VYoOnJ1svT0)

- **COD testing**
  - ✓ Prior to completing the COD test, a series of known standards are prepared using KHP (potassium hydrogen phthalate). Most wastewater samples will fall in the high range, so standards of 100, 250, 500 and 1000 mg/L are typically prepared. COD standards can also be purchased.
  - ✓ A COD reactor/heating (150°C) block and a colorimeter are turned on so that both instruments are allowed to stabilize.
  - ✓ Pre-prepared low-range (3-50 ppm) or high-range (20-1500 ppm) vials are selected for the COD test based on expected results. Both ranges can be used if expected results are unknown.
  - ✓ One vial is marked as a "blank," and three or four vials are marked with known standard levels. Two vials are then marked for the wastewater sample to make a duplicate run. Note: If multiple wastewater samples are being run, at least 10% of samples are duplicated.
  - ✓ 2 mL of liquid are added to each vial. In the case of the "blank," 2 mL of DI water are added. 2 mL of each standard are added to the corresponding vials. If the wastewater sample is tested at full strength, then 2 mL is added to the corresponding vial. If dilution is required, then serial dilutions are performed and 2 mL of the diluted sample are added to the corresponding vial.
  - ✓ Each vial is mixed well and placed into the reactor block for two hours. After two hours, the vials are removed from the block to a cooling rack for about 15 minutes.
  - ✓ The colorimeter is set and calibrated per the specific instructions for that unit (i.e., proper wavelength, blank and standards) and each vial is placed in the unit and the COD concentration read.

A wastewater treatment plant is not a nuclear power plant but still you can encounter some difficulties when operating with the following possible problems with WWTPs:

- Overheating of blowers and lack of air in the system
- Exceeding prescribed drainage limits
- Sludge leakage from the settling tank
- Low dry matter content of drained sludge

I. Overheating of blowers and lack of air in the system

A frequent problem in the treatment plant is the long-term low oxygen concentration in the tanks **(<1.0 mg / l)**. However, short-term fluctuations (a few tens of minutes) may not necessarily be a complication. However, if the amount of oxygen is low in the long term, **this can lead to deterioration of drainage parameters, foam formation on the surface** and similar problems.

II. Exceeding the limits

COD (chemical oxygen demand) – organic substancesexceeding the limits in the COD indicator mayhave several causes. These are related, for example, to the leakage of sludge from the storage tank, or to the overloading of the treatment plant and the inadequate removal of organic matter, as we described in one of our previous articles.

A. Phosphorus

- **Phosphorus removal can be achieved in three ways:**
  - ✓ First of all, phosphorus used by bacteria to grow new cells. The rule says that for the removal of 1000 mg of organic substances in the form of COD, bacteria need 1 mg of phosphorus to grow.
  - ✓ The second way is to use the ability of bacteria to accumulate storage media (also phosphorus) in themselves under anaerobic conditions. For this a special tank is usually included in the WWTP.
  - ✓ The third way is to use iron or aluminum containing substances that precipitate residual phosphorus. However, in the case of precipitation it is necessary to expect an increase in the amount of sludge by the so-called chemical sludge.

B. Nitrogen

If you exceed the limits of nitrogen, it is probably related to biological processes. Just like phosphorus, nitrogen is also an element that bacteria inevitably need to grow. Here the

common ratio is that about 1,000 mg of COD removed, bacteria needs 5 mg of nitrogen to grow.

- **Insufficient nitrification (removal of N-NH4):**
  - ✓ It may be associated with excessive dosing of the nitrogen into the system. or
  - ✓ Feed may contain substances that act toxic to the nitrifying bacteria and inhibit the whole process.
  - ✓ Poor efficacy may also be related to pH outside the optimum range for microorganisms (pH = 6.5-8.0). At this point it is necessary not to forget that in the case of the conversion of ammoniacal nitrogen into nitrates the H+ ion is produced in the reaction and thus decreases the pH of the system.
- **The second step of removing nitrogen is denitrification:** (conversion of nitrate nitrogen to gaseous nitrogen - the final step of removing the element from the water)
  - ✓ **A prerequisite for the process is the presence of organic carbon**. It is this fact that is the most common indicator of whether or not it will happen. For the reliable operation of the process the COD ratio: NO3-N = 3-4 must be observed.
  - ✓ If denitrification does not "run" it is likely that **oxygen is present in the denitrification zone**. Therefore, the anoxic conditions for this type of bacteria are not suitable in the system.
  - ✓ Insufficient nitrate removal may be associated with insufficient denitrification / anoxicity.
  - ✓ Talking about pH, OH-ion is formed in this process and the pH is thus increased. You can learn about the legislation on waste water disposal and fines for exceeding the limits

III. Sludge leakage from the settling tank

This phenomenon may be related to oxygen deficiency or nutrient deficiency. Then the **bacteria** begin to adapt to new, less satisfactory conditions and **grow in the form of chains**. At the same time, they are intertwined and form parts which have poor sedimentation properties because of a lower density of the sludge mixture.

- It can also be adversely affected by the long residence time in sedimentation tanks when denitrification bacteria can start to produce nitrogen gas.
- If they have adequate conditions (enough COD, enough N-NO3, anoxic environment and others), **they start decomposing the nitrates into gaseous nitrogen.**
- **In the form of small bubbles it will move to the surface causing swirl,** or bubbles will pull up sludge flakes and bring them to the surface.

IV. Low dry matter content of drained sludge

Indeed, in this part of WWTPs much depends on the composition and the dry matter of sludge at the inlet of the dewatering line. For example, for sludge with higher fat content the centrifuge is designed slightly differently than with conventional biological sludge. It is important for the supplier to consult the suitability of the flocculants for the process and its dosage.

One of the basic divisions is the division into cationic and anionic or nonionic flocculants. Just because of their quantity and variety, it is recommended to subject the wastewater to flocculation testing as well. Parameters that need to be addressed are the formation of flakes and at the same time their strength, so that they do not fall apart during the dewatering process.

Another division is division into powder and emulsion flocculants. Powders, after being dissolved in water, form long chains, while emulsion flocculants form spatial structures (nets).

In many operations, emulsion flocculants are praised and considered being more efficient. This advantage is, however, associated with a higher price for the product.

6.2. Take corrective actions

Dairy wastewater has a high organic load, requiring biological treatment for permit-compliant discharge. Together they are typically adequate for compliant discharge into sewer authority collection systems. What treatment is used depends on the waste-load volume and concentration. Milk product values for biochemical oxygen demand can range as follows:

- Whole milk: 85,000-110,000 Mg/L BOD
- Skim milk: 60,000-80,000 Mg/L BOD
- Buttermilk: 50,000-70,000 Mg/L BOD
- Whey: 20,000-40,000 Mg/L BOD

Production in a dairy is batch type, i.e., one batch of milk is processed, the equipment is drained, thoroughly cleaned and the next batch is taken for processing. Because the flow of waste water from a dairy comes in slugs, a hydraulically loading wastewater treatment is a distinct possibility.

The amount of water used in a dairy, which can generate average wastewater ranges between one and six gallons for every one gallon of milk processed, is the source of the hydraulic load. Most of the load is related to required sanitation, including equipment cleaning and washing floors.
The characteristics of dairy waste can range as indicated below:

- BOD 500 – 3,000 Mg/L i.e., Bio chemical oxygen demand
- COD 750 – 7,500 Mg/L, i.e., chemical oxygen demand
- TSS 500 – 1,500 Mg/L, i.e., total suspended solids
- O&G 200 – 1,000 Mg/L, i.e., oil & grease

Other dairy-waste characteristics include lactose, protein, fat, oil and grease presence; hydraulic overloads due to water dumps or wash water; variable pH levels as sanitizing chemicals affect wastewater treatment; wastewaters may be generated at receiving stations, pasteurization and homogenization; washing and sanitizing are important and wastewater sources include spills and spoiled product. The COD and BOD relationship is favorable for applying biological treatment processes following certain stringent preliminary and primary treatment processes.

6.2.1. Preliminary and primary

Equalization reduces hydraulic overloads and the possibility of flow-variation shock loads. Equalization ensures a reasonably uniform volume and composition flow, available for discharge to each subsequent wastewater treatment. Equalization process control may be limited to available volume capacity. Equalization capacity requirements change as incoming wastewater characteristics change. Mixing increases the effectiveness of equalization.

The pH, as an expression of base or acidic intensity of wastewater is mathematically expressed as the logarithm (base 10) of the reciprocal of hydrogen ion activity. Changing the ion activity of wastewater causes certain compounds in wastewater to either be in solution as soluble or convert to a physical form. Adjusting pH, known as neutralization, is adding an acid or alkali (base) to wastewater, causing the pH of to go up or down to accommodate a treatment process. Process controls establish an optimum pH to perform a treatment process, for chemicals use and for equipment and instrumentation to consistently control pH.Flow is the movement or velocity of wastewater, measured typically in gallons per minute. Flow control establishes and maintains a desired flow rate for pumping wastewater, chemicals or sludge.

6.2.2. Coagulation and flocculation

- **Coagulation**: is the clumping together of very fine particles into larger particles (floc) caused by the use of chemicals (coagulants). Chemicals neutralize the electrical charges (ions) of the fine particles, allowing them to come closer and form larger clumps. Flocculation is the gathering together of fine particles after coagulation to form larger particles by a process of gentle mixing.

- **Flotation**: removes oils and greases, separates physical solids and decreases BOD associated with physical solids, using a dissolved air flotation (DAF) clarification process unit. Doing so ensures consistent floating of flock from clarified wastewater. Sedimentation is the settling of physical solids to the bottom of a solids separation or clarification process unit. It allows the consistent settling of flock from clarified wastewater.

6.2.3. Secondary or Biological treatment

Activated Sludge via extended aeration uses an aeration basin, secondary clarifier and sludge-holding or digestion-process units. Controlling activated sludge includes maintaining acceptable continuous primary treated wastewater entering the activated sludge process and maintaining activated sludge processes to discharge compliant secondary or final clarifier effluent. Dairy Waste Treatment Two types of treatment methods are normally used in dairy industry i.e., chemical and biological treatment.

6.2.4. Mechanical treatment

This is preliminary stage of dairy waste treatment and in this screens, grit chamber, skimming tank and primary sedimentation tank or clarifier are used. The large material which are floating in nature are removed by removed by screens, otherwise matter may chock the pipes while further effluent processing.

6.2.5. Chemical treatment

Chemical treatment is also known as precipitation. The precipitation is done by adding flocculating material called as flocculants to waste water and mixed vigorously by agitators. This process precipitate insoluble phosphate in the form of very fine particles then the particle aggregates into larger flocks. The larger flocks settle down in in the pre-sedimentation basins as primary sludge, where a clear effluent overflows into a basin for biological treatments.

6.2.6. Biological treatment

Dairy effluent contain mostly organic waste therefore, biological degradation is the most promising options for the removal of organic material. However, sludge formed, especially during the aerobic biodegradation processes, can lead to serious and costly disposal problems. This can be aggravated by the ability of sludge to adsorb specific organic compounds and even toxic heavy metals. However, biological treatment has the benefits of microbial transformations of complex organics and possible adsorption of heavy metals by suitable microbes. Biological treatments of waste treatment have great potential for combining various types of biological schemes for selective constituent's removal

(https://www.youtube.com/watch?v=A5FBMKkhO24)

A. **Aerobic treatment:** In aerobic biological treatment methods the microorganisms grown in an oxygen-rich environment, to degrade the organics to carbon dioxide, water, and cellular material by oxidizing matter. Systems of aerobic treatment can include the conventional activated sludge process, the rotating biological contactors, the conventional trickling filters.

B. **Anaerobic treatment:** Anaerobic treatment is basically for treating high strength waste water by biological process. Anaerobic digestion is a process by which microbes are used in the absence of oxygen for the stabilization of organic matters by conversion to biogas (methane and CO_2 biomass and inorganic products. 5% of the organic load in a waste stream can be converted to biogas (methane and carbon dioxide) and the remainder is utilized for cell growth and maintenance. The process reactors are covered to prevent the entrapment of air and the release of odor

.

C. **Sludge treatment**: Each treatment stage generates sludge and that sludge is collected in thickening tanks to which chemical are added to further facilitate the aggregation of solid particles. Sludge is a homogenous, practically odorless, dark-colored Sludge contains high amount of organic material so it has to further break down so that foul-smell reduced down.

6.2.7. Physic-chemical process

D. **Electro coagulation (EC):** The electro coagulation (EC) process can be the alternative process for treating dairy wastewaters. Electro coagulation is process of electrolysis, which removes dissolved organic waste, turbidity and coloring matter by passing electrical current through the effluent using special electrode.

E. **Adsorption:** Among the various physic-chemical treatment methods, adsorption has been found to be attractive for the removal of organic compounds in wastewaters. For treatment of wastewaters, among other types of adsorbents mostly activated carbon is used. Although some other adsorbents also can be used for treatment of wastewater streams and are also cost effective for e.g., rice husk ash, coal fly ash etc.

F. **Membrane treatment:** The common membrane separation processes are microfiltration, Nano filtration, ultrafiltration, reverse osmosis and electro-dialysis. High feasible product recovery is possible with these methods and effluent produced is of high quality able to be directly used

6.2.7. Aerobic Process

- **Sequencing Batch Reactor (SBR):** Sequencing batch reactor (SBR) seems to be the most promising technology using which dairy wastewater can be treated consists of a set of tanks that operate on basis of a fill-and draw activated sludge for removing undesirable components. The tanks may be an earthen or oxidation ditch, a rectangular basin, or any other concrete/ metal type structure. Each tank in the SBR system is filled during a discrete period of time and then operated as a batch reactor. After desired treatment, the mixed liquor is allowed to settle and the clarified supernatant is drawn from the tank.

6.2.8. Anaerobic process:

- Anaerobic process is a biological process performed by active microorganisms in the absence of exogenous electron acceptors. It was reported that up to 95% of the organic load in waste water stream can be converted to biogas (methane and carbon dioxide). Anaerobic process of dairy waste also yields methane, which can be employed as a heat or power source.

A. **Up Flow anaerobic sludge blanket (USAB):** UASB reactors have been most widely used for the treatment of dairy and food wastewater [2. The basic components of a typical UASB reactor are a sludge blanket, gas-solid separator, influent-distribution system and the effluent-withdrawal system.

B. **Hybrid anaerobic digesters:** A lab scale on mesophilic hybrid anaerobic digester, consist of combination an UASB and an anaerobic filter design, was used for dairy effluent treatment.

C. **Anaerobic sequencing batch reactors (ASBR):** ASBRs also used for obtaining high quality of dairy effluents. The lab scale study on ASBR system was carried out to provide removal of COD and BOD5 rates of 62 and 75 percent respectively.

6.3. Implement emergency procedures

In a chemical emergency, if you come in contact with a known or unknown chemical, you should get away from the area, get it off your body as soon as you can, and get help by calling the Poison Control Center at 800-222-1222 or calling 911 or going to the nearest hospital. Since chemical emergencies can happen at any time, plan ahead so you are ready to evacuate or stay put and seal off your space.

Chemical hazards can enter surface waters or be deposited on beaches from anthropogenic sources or natural sources (e.g. hyperalkaline lakes). Contamination may be from point sources, such as industrial outfalls, or non-point (diffuse) sources, such as runoff from land. In most cases, particularly where there are riverine flows or tidal movement, contaminants will be significantly diluted or dispersed, minimizing public health risks. There are very few reports of human health impacts associated with recreational exposure to chemicals in fresh or marine waters

6.3.1. Exposure assessment

A. How does dairy industry cause water pollution

From the beginning, milk was considered one of the greatest sources of vital nutrients out of all other food products. With rapid industrialization, the dairy industry is expanding at about 4.2 percent annually since 2000. Because of this, there is a rise in water pollution as well.

B. Impact of dairy industry on environments

The dairy industry is the largest polluter of water generating an estimate of 2.5 to 3 liters of wastewater for every litre of milk processed. Water is a critical resource in milk processing units and is used for various purposes such as;

- Cleaning,
- Washing,
- Disinfection,
- Cooling And
- Heating

The wastewater released emerges spillage from leakages, overflows of cans, and products like whey. As a result, it produces high BOD and COD loads.The efficiency of wastewater treatment management for dairy industries is based on the daily;

- Volumetric loading and

- Flow rates.

However, it becomes complicated as each milk product requires separate technological cues, resulting in regular effluent composition change.

I. Characteristics Of Dairy Wastewater

The dairy industry contributes to producing large volumes of industrial wastewater containing high organic load that cannot be eliminated easily. The wastewater released by the industry is generally white or yellow. The organic compounds such as lactose, whey proteins, nutrients and fats cause foul odour, provoking distress in the degradation stage. Usually, the effluents have high COD BOD levels along with TSS levels. The characteristics of dairy effluents depend on:

- An industrial scale,
- Processing types,
- Process parameters,
- Type of operation,
- Type of water discharged and
- Many others

Dairy effluent remains one of the primary causes of water pollution because of an enormous amount of organic load, one of the best sources of nutrients for bacteria, algae, and fungi.

II. Environmental effects of dairy wastewater

The dairy effluents are responsible for causing foul odour and turbidity in the water. The organic concentration present in the effluent becomes toxic for the aquatic ecosystem.

- **Casein** is one of the main compounds released from the dairy industry. When subjected to degradation, it turns into highly foul-smelling black coloured waste. This can even cause the death of aquatic organisms.
  - ✓ When mixed with freshwater sources, the effluent can cause hormonal imbalance in marine lives and human beings. It is essential to treat the wastewater before releasing it to avoid eutrophication and oxygen depletion in the marine environment.

- ✓ The biological wastewater treatment method can be used to treat wastewater well. Rather than opting for harsh chemicals to treat the effluent, healthy microbial strains can help in treating the effluent without causing any harm to the environment.

Self-check 6	Written test

Full Name…… ID…… Date…….

Directions: Answer the following Question accordingly to the instructions

Test I: Choose the best answer (4 point)

1. Which of the following are not characteristics of dairy product wastewater?
   A. color, pH (5.5-10.5),
   B. BOD (0.35-1.8 kg),
   C. dissolved solids,
   D. Oil and grease
   E. Pure water
2. Which of the following is not true about dairy product processing wastewater rage of the BOD values?
   A. Whole milk: 85,000-110,000 Mg/L BOD
   B. Skim milk: 60,000-80,000 Mg/L BOD
   C. Buttermilk: 500-700 Mg/L BOD
   D. Whey: 20,000-40,000 Mg/L BOD
3. One of the following is not a biological treatment of wastewater?
   A. Aerobic treatment
   B. Anaerobic treatment
   C. Sludge treatment
   D. Electro coagulation

Test II: Short Answer Questions (8 points)

1. What is the difference between BOD and COD in terms of dairy product wastewater treatments?

Note: Satisfactory rating 9 points Unsatisfactory below 9 points

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

Operation Sheet -6

6.1 Techniques/Procedures/Methods of BOD program for wastewater tasting

A. Materials, Tools and equipments

- **Equipments**
  - ✓ BOD meter with probe for measurement of dissolved oxygen in 300 mL BOD bottles
  - ✓ 300 mL BOD bottles
  - ✓ Incubator, capable of maintaining 20 +/- 1°C
  - ✓ 250 mL graduated cylinders
  - ✓ 100 mL graduated cylinders
  - ✓ 25 mL measuring pipettes (wide-mouth)
  - ✓ 10 mL measuring pipettes (wide-mouth)
  - ✓ 100 mL beaker
  - ✓ 1000 mL beaker
  - ✓ 250 mL Erlenmeyer flask
  - ✓ Burette graduated to 0.1 mL
  - ✓ Dilution water bottle of suitable volume for the number of tests to be performed
  - ✓ Pipette bulb
- **PPE**(chemical glove, boats aver all, lab hats, mask, glass)
- **Reagent**
  - ✓ Phosphate buffer solution
  - ✓ Magnesium sulfate solution (MgSO4 7H2O) *
  - ✓ Calcium chloride solution (CaCl2) *
  - ✓ Ferric chloride solution (FeCl3) *
  - ✓ Sodium hydroxide (NaOH), 1 N
  - ✓ Sulfuric acid (H2SO4), 1 N *
  - ✓ Sodium sulfite (Na2SO3), 0.025 N
  - ✓ Potassium iodide solution (KI), 10%
  - ✓ Acetic acid solution (CH3CO2H), (1+1) *
  - ✓ Sulfuric acid solution (H2SO4), (1+50) *
  - ✓ Starch indicator solution
  - ✓ Glucose-glutamic acid solution
  - ✓ Nitrification inhibitor (2-chloro-6-(trichloromethyl) pyridine) *
  - ✓ Distilled water

Points to be considered before preceding the actual Tasks

- In order to calculate the BOD, the laboratory is sampling some waste water, and then is diluting it in a BOD incubation bottle. The lab must measure the following data.

D1 = oxygen diluted level in the diluted sample at t=0 (mg/l),

D2 = oxygen diluted level in the diluted sample at t=5 days (mg/l), B1 = oxygen diluted level in the dilution water at t=0 (mg/l),

B2 = oxygen diluted level in the dilution water at t=5 days (mg/l),

V1 = volume of wastewater sampled for dilution (ml) and V2 = volume of diluted sample (ml)

B. Prepare dilution water

1. Take five liters of double distilled water in glass container
2. Aerated the water with the clean compressed air for not less 12 hours
3. Allow stable for at least 6 hours at 20 ^{0}c
4. Add 5ml of 27.5 %w/v solution of calcium carbonate
5. Add 5 ml 22.5 % w/v solution of magnesium sulfate
6. Add 5ml of 0.15 % w/v solution of ferric chloride
7. Add ml of phosphate buffer solution
8. Mix well and allow to stand for 2hr

C. Determination of BOD of wastewater

1. Take 4 300ml BOD bottle and 10 ml of samples two bottles and fill the remaining volume with dilution water
2. Fill the remaining two BOD bottle only with dilution water for blank
3. Immediately close the bottle when filled there should not any air bubble in the bottle
4. Make the bottles as blank and sample

5. Incubate one sample and one blank bottle at 20 ^{0}c for 5 days
6. Analyze immediately remaining one blank and one sample bottle of dissolved oxygen demand (DO)
7. Analyze incubated bottle for DO after 5 days

Noted:

- Takes 10 ml of wastewater and dilute it in a BOD incubation bottle of 250 ml.
- Then measures the oxygen level in the diluted water and gets 10 mg/l at t=0 and 2 mg/l at t=5 days,
- Takes also the same measures on the dilution water and gets 9.5 mg/l at t=0 and 8 mg/l at t=5 days.
- Now, calculate the BOD_5 of the effluent

LAP Test-6	Performance Test

Full Name…….…… ID…… Date……...

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within **2** hour.

The project is will expected from each student to do it.

Task 1: Provide and prepare materials need for BOD analysis

Task 2: Apply preparation of distiller water for calibration

Task 3: Determining the BOD value of wastewater

LG # 07	LO 7: Analyze and Respond to Abnormal Performance

Instruction sheet-7

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

- Maintaining work place record
- carrying out handover work place procedures
- Aware waste water treatment

Carrying out pre-start checkThis 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**:

- Maintain work place record
- Carry out handover work place procedures
- Aware waste water treatment

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets.
4. Accomplish the “Self-Checks” which are placed following all information sheets.
5. If you earned a satisfactory evaluation, proceed to “Operation Sheets.
6. Perform “the LAP Test” which is placed following “Operation sheets”.
7. If your performance is satisfactory, proceed to the next Learning Guide.

Information sheet-7

7.1. Maintaining workplace records

Records are observations, measurements, and other data recorded manually or by means of monitoring equipment, to document the devotion to critical limits or other processes requires Records are the collected information produced by the industry in the process of performing and reporting industry operation. Characteristics of records are that they:

- Need to be easily retrieved or accessed;
- Contain information that is permanent, and does not require updating.

7.1.1. Records should be

- Legible and clear
- Dated
- Readily identifiable and retrievable;
- Carry authorization status;
- Retained for a designated period;
- Protected from damage and deterioration while storage.
- All calculations should be duly recorded

7.1.2. Recording information

Records are observations, measurements, and other data recorded manually or by means of monitoring equipment, to document the devotion to critical limits or other processes requires. Records are a tool used to confirm that things are working effectively. Records can:

- Provide a means to track/path and review deviations
- Identify the root cause of an issue
- Help improve a process
- Identify trends/tendencies indicating that a process is moving towards deviation

7.1.3. Production batch records

Documentation is the electronic or written record of all information regarding methods, conduct, and/or results of industry work; the factors affecting results of industry work; and the regular or corrective actions taken. Batch records should include documentation that each significant step in the production of the batch was accomplished including;

- Specific identification of each batch, including
- Materials used during manufacturing
- Reagent record.
- Identity of major equipment used;
  - ✓ Chart of accounts (COA)records
  - ✓ Equipment log.

Good records enable one to track all activities performed during batch manufacture, from the receipt of raw materials to the final product release; they provide:

- History of the batch
- Distribution
- Essential part of GMP to keep accurate records,

7.1.4. Signing all records

- The initials or signature of the person who performs each test and the date the tests were performed;
- The initials or signature of a second person verifying for:
  - ✓ Accuracy
  - ✓ Completeness
  - ✓ Compliance with established standards

- The initials or signature of a person (supervisor/QA) reviewing the document.

7.1.5. Communicating recorded information

Communication is the transfer of facts, ideas, opinions, feelings and information from one person or group to another. It is how we come to know and understand everything around us.

I. Operator communicate and seeking advice from supervisor to fulfil the job

- How to collect samples and conduct tests
- How to take corrective action.
- Operational health and safety (OHS) hazards and controls
- Common causes of variation and corrective action required
- Good Manufacturing Practice (GMP
- Basic operating principles of process control
- Workplace information such as;
  - ✓ Standard Operating Procedures (sops)
  - ✓ Specifications
  - ✓ Production schedules and instructions
  - ✓ Manufacturers' advice
  - ✓ Standard forms and reports
  - ✓ Critical control points

7.2. Carrying out handover work place procedures

7.2.1. Up flow anaerobic sludge blanket reactor (UASB)

The Up flow Anaerobic Sludge Blanket Reactor (UASB, maintains a high concentration of biomass through formation of highly settle able microbial aggregates. The sewage flows upwards through a layer of sludge the process is suitable for both soluble wastes and those containing particulate matter.

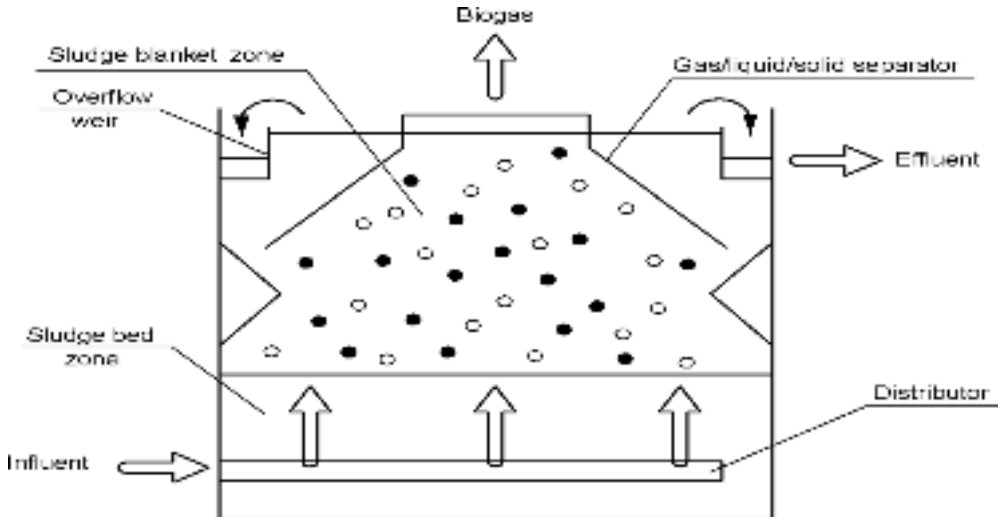

Figure 7.1: Schematic diagramof an up flow anaerobic sludge blanketreactor

7.2.2. Daily operation and maintenance ofUASB

A. Cleaning of effluent gutters

All V-notches must be cleaned in order to maintain the uniform withdrawal of UASB effluent coming out of each V-notch. The irregular flow from each V-notch results in the escape of more solids washout. Similarly, blocking of the V-notches of the effluent gutters will lead to un3e8v7en0 distribution of sewage in the reactor. Therefore, the effluent gutters have to be inspected on a regular basis to remove any material blocking and even the outflow over the V-notches in the gutters. The regular maintenance involves cleaning of V-notches with a broom three times a day and removing sludge with a brush or with a water jet once a day.

Figure 7.2: Cleaning of effluent gutters

B. Unclogging feeder pipes

The feeder pipes should be checked regularly for clogging. Flexible iron rods can serve the purpose. A submersible pump can be used to unclog the feeder pipes (Fig. These feeder pipes ar3e88g0enerally clogged due to rags and floating material. It is necessary to provide a fine screen or extra prevention at the screen to capture floating material at the pre-treatment unit itself.

Figure 7.3: Schematic of DAF unit

C. Removal of floating mat

Floating mat must be removed from the top of the surface of reactor with a rake. The removed material should be disposed at the dumping site.

D. Check of leakage of biogas

The gas collectors should be checked for leakage. Leakage is easily detected by applying soap solution to piping. This should be done on a regular basis. If the gas collectors are leaking, the valve at the end of one bay in the gas leak should be first closed and then repaired as soon as possible. Regular maintenance includes opening of hatch boxes and removing floating layer inside the gas collectors.

E. Scrubbing of biogas

The risk of the corrosion of dual fuel engine parts, as biogas contains H_2S, can be minimised if biogas can be scrubbed before using it as fuel for dual fuel gas engines.

F. Check for sludge withdrawal ports

The ports of the sludge withdrawal must be free from any clogging which reduces the chances of checking of sludge height in reactor. The feeder pipes should be checked regularly for clogging. Flexible iron rods can serve the purpose. A submersible pump can be used to unclog the feeder pipes.

G. Methanogenic activity

Successful operation of a UASB reactor depends upon maintaining a satisfactory balance between meth and acidogenic bacteria. The methane formers are susceptible to changes in environmental conditions such as ph, temperature etc. The Methanogenic activity must be analyzed monthly.

H. Proper sludge wasting

Sludge must be removed or transferred from the UASB reactor occasionally based on the sludge yield of total suspended solid (TSS) or volatile suspended solids (VSS). Higher sludge withdrawal points to a poor performance of the reactor in terms of treatment

I. Biogas analysis

The biogas analysis is used largely at sewage treatment plants where information on fuel value of gas is important. Such changes can thus be used as a warning sign to suggest the need for closer observation and control of treatment unit.

J. H_2S Determination

The determinant hydrogen sulphide will continue to be an important consideration wherever gas is used for fuel in gas engines, particularly in areas where the sulphate content of sewage is very high.

K. Sludge pumping station maintenance

After every sludge withdrawal operation, clean the pipeline by opening the top flushing valve until all sludge in the pipeline is washed out. The sump has to be cleaned with water. Never keep the sludge in the sump, it may damage the pumps. Before getting into the sumps for any maintenance, keep the top cover open for an hour before anybody gets in so that any accumulated biogas will vent to the atmosphere. Keep the valve chamber dry and valves clean. Check the electrical components regularly.

7.2.3. Biogas holder operation and maintenance

The biogas produced in the reactors is taken in the common **Fiberglass Reinforced Plastic** (FRP) pipes to the biogas holder. The biogas before going to the gas holder passes through moisture trap. The gas coming to the gas holder is measured through gas flow metres connected to FRP pipe after the moisture trap The biogas before going to the holder is branched off.

One branch is taken to the flaring system, the other to the biogas engine. Before going to the engine, the gas is measured from the flow meter provided on pipeline going to the engine. Sluice valves are provided on the lines to isolate the flow which is manually operated. This is one of the reasons for having a gas holder level trap. The typical UASB preventive maintenance check list is below.

- Date and time
- Check and clean weir levels of division boxes
- Clean-up- feed inlet points
- Cleaning of V-notches

- Removal of sludge from effluent gutter by water jet or brush
- Removal of floating layer on the top of reactor
- Cleaning and scrubbing of effluent channels
- Check gas pipes for leakage
- Leakage greasing of spindle of sludge valves
- Cleaning of sludge sump

7.3. Aware waste water treatment

7.3.1. Wastewater treatment process

Every day, wastewater goes down the drains from homes, schools, businesses, and factories and flows into Sewer System. In most areas of the city, the combined sewer system collects and conveys wastewater and storm water runoff from;

- Streets,
- Sidewalks, and
- Rooftops, together to a wastewater resource recovery facility.

Wastewater undergoes five major processes of treatment, which closely mimic how

- Wetlands,
- Rivers,
- Streams, And
- Lakes Naturally Purify Water.

A. Preliminary Treatment

Several stories underground, incoming wastewater, called influent, flows into the facility from the sewer system. As wastewater enters the facility, it passes through bar screens to remove leaves, twigs, and litter such as plastic bags, food wrappers, bottles, and sanitary wet wipes. We collect the trash and debris and then it is trucked to landfills. Main sewage pumps then pump wastewater from the screens up to the surface level of the facility.

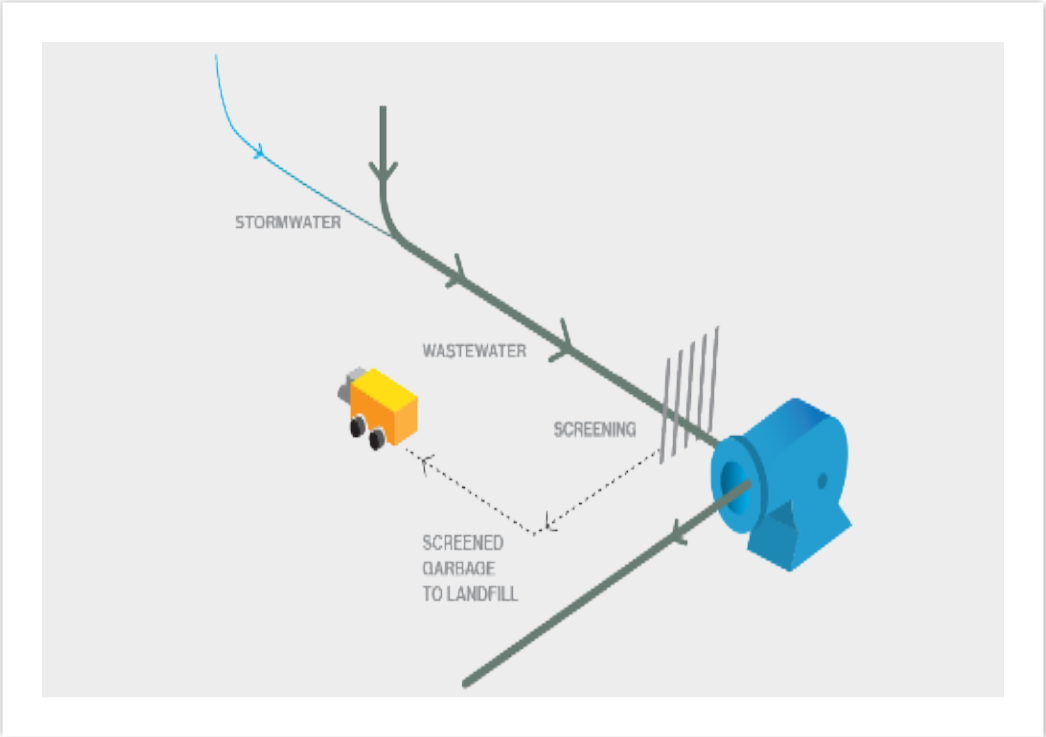

Figure 7.4: Screening and Pumping

B. Primary Treatment

Next, the wastewater enters primary settling tanks where the flow of water slows down. We skim off the lighter solids that float, such as grease and small plastic material from the surface of the tanks. Meanwhile, sludge, or the heavier organic solids (feces, food, and paper fibers), begins to sink. We remove this primary sludge from the bottom of the settling tanks for thickening and digestion.

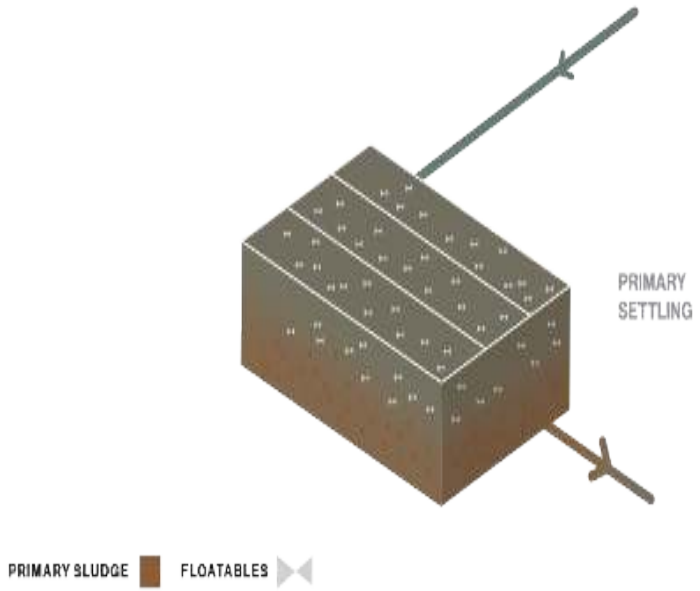

Figure 7.4: skim off the lighter solids

C. Secondary treatment

During secondary treatment, we add air to aeration tanks to foster a healthy environment for oxygen-loving microorganisms that are naturally present in the sewage. These helpful microorganisms consume much of the organic material in the wastewater, which yields heavier particles that can be removed more easily. Aerated wastewater then flows to final settling tanks, where the heavier solids settle

to the bottom. We remove most of this secondary sludge and combine it with the primary sludge for thickening and digestion. We return some of the secondary sludge to the aeration tanks to help maintain the right mix of helpful microorganisms and process incoming wastewater.

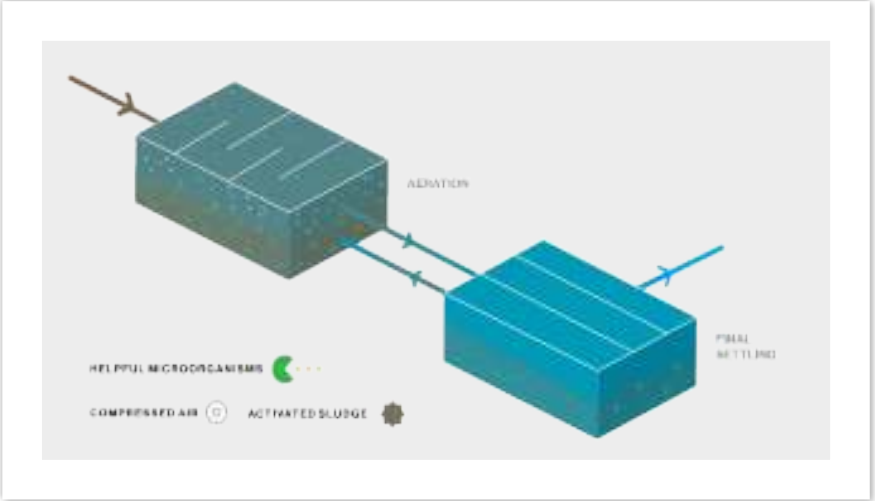

Figure 7.5: Aeration and Final Settling

D. Disinfection

We add **sodium hypochlorite**, the same chemical found in household bleach, to disinfect wastewater and remove any remaining disease-causing microorganisms. We then release the treated wastewater, or effluent, as clean water into local waterways.

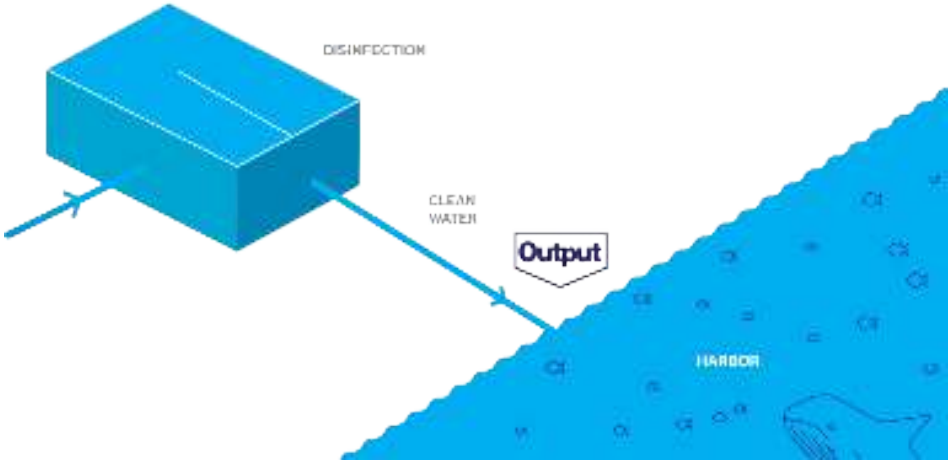

Figure 7.6: Disinfestations and releasing pure water to the environment

E. Sludge treatment

We thicken the sludge that we collected during primary and secondary treatment to further separate out water from the solid material. We place the thickened sludge into tanks called digesters, which maintain a low-oxygen environment heated to about 98°F. Microorganisms that thrive in this anaerobic environment digest the sludge and much of the material is converted into methane gas, also called biogas.

After about 15 days, the treated sludge goes through dewatering, which removes water from the solids using large centrifuges (like the spin cycle of a washing machine). We can dewater at six of our 14 wastewater resource recovery facilities. For the other eight facilities, we use marine vessels to transport the treated solids for dewatering. The remaining solids, called biosolids, can be composted, added to agricultural soils, or further processed for other beneficial uses.

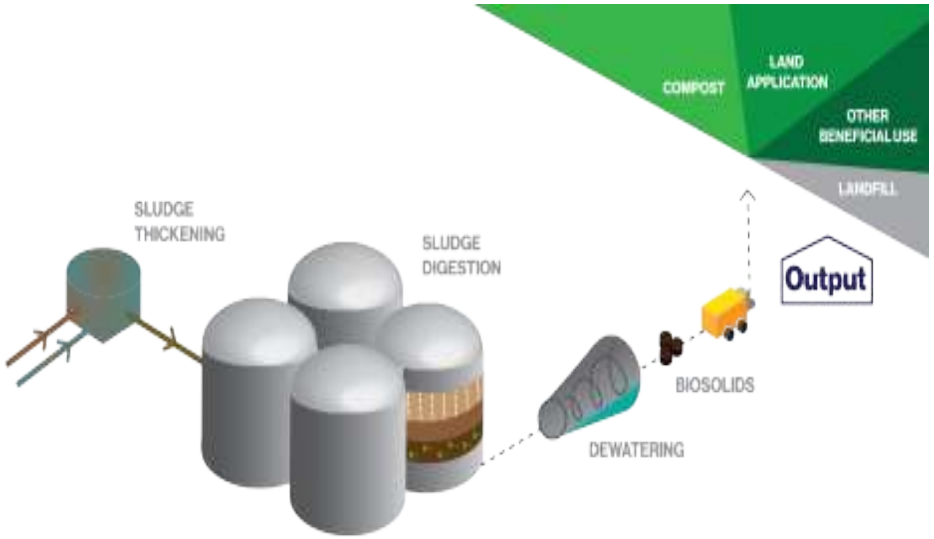

Figure 7.6: Sludge thinking and digestion system

F. Waste-to-Energy

The biogas released during sludge digestion can be used to produce heat and electricity for the wastewater resource recovery facilities. Once purified it can be distributed as renewable natural gas for the community. Recovering and reusing biogas enhances clean air operations and significantly reduces greenhouse gas emissions from our wastewater resource recovery operations.

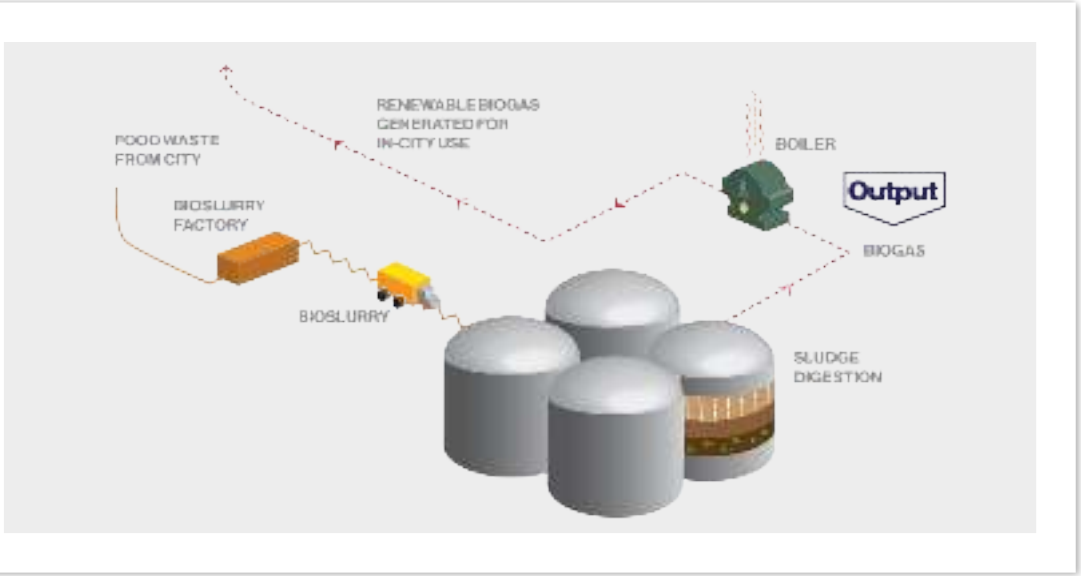

Figure 7.7: Renewable of wastewater

Self-check 7	Written test

Full names Name…… ID…… Date…….

Directions: Answer the following Question accordingly to the instructions

Test I: Choose the best answer (4 point)

1. Which what is the components of daily Operation and Maintenance ofUASB?
    A. Cleaning of Effluent Gutters
    B. Unclogging Feeder Pipes
    C. Removal of floating mat
    D. Check of Leakage of Biogas
    E. All of the above

2. ----------system, microorganisms consume much of the organic material in the wastewater?Preliminary Treatment
    A. Primary Treatment
    B. Secondary treatment
    C. Disinfection
    D. Sludge Treatment

Test II: Short Answer Questions (8 points)

3. What is up flow anaerobic sludge blanket reactor **(UASB)**?

Note: Satisfactory rating 9 points Unsatisfactory below 9 points

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

LG #8	LO 8: Obtain and Provide Information in Response to Workplace Requirements

Instruction sheet-8

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

- Obtaining specific and relevant information
- Interpreting important information
- Writing information accurately
- Identifying appropriate contact source of information
- Carrying out personal interaction
- Defining workplace procedures and storage of 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:**

- Obtain specific and relevant information
- Interpret important information
- Write information accurately
- Identify appropriate contact source of information
- Carryout personal interaction
- Define workplace procedures and storage of information

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets.
4. Accomplish the “Self-Checks” which are placed following all information sheets.
5. If you earned a satisfactory evaluation proceed to “Operation Sheets.
6. Perform “the LAP Test” which is placed following “Operation sheets”.
7. If your performance is satisfactory proceed to the next Learning Guide.

Information Sheet-8

8.1 Obtain specific and relevant information

8.1.1 Important records maintained in the workplace

- Product information labelling and consumer awareness,
- Production , quality or processing,
- Cleaning, sanitation and pest control,
- Legal requirement,
- Human resource or manpower related,
- Marketing information,
- Engineering or utility of the processing plant,
- Documentation and record keeping.

8.1.2 Meaning of specific and relevant information

Relevant information is data that can be applied to solve a specific problem in a particular area of work. This is a particular issue when determining the format and content of an entity's financial statements, since the proper layout and level of detail of information can adjust the opinions of users regarding the future direction of a business.

A relevant information source answers question work place requirement and it is done to determine relevance, the purpose and bias must be understood. In fact, all aspects of evaluation must be taken into consideration to determine relevance.

Criteria for becoming the workplace requirement information specific and relevant;

- The source must be credible.
- It should be verifiable.
- The source must also be accurate.
- The third criterion is that the source is relevant.

8.1.3 Obtaining specific and relevant workplace requirement information

Information is obtained or collected from many different sources, including emails, reports, customer records and surveys, telephone calls, meetings, informal and formal communication networks, journals and computer sources in regarding to the workplace requirement.

Consider the following points as a check list on finding credible sources;

- Examine the sources and owner's credentials and affiliations.
- Evaluate what sources are cited by the plant owner.
- Make sure the source is up-to-date.
- Check the endorsements and reviews that the source received.
- Check if the data recorder and encoder of the source are reputable.

Strategies to gather reliable information relevant to workplace practices may include;

- Get organized human resource.
- Locate background information.
- Identify your information needs based on tasks.

8.2 Interpreting important information

Data interpretation is the process of reviewing data through some predefined processes which will help assign some meaning to the data and arrive at a relevant conclusion. It involves taking the result of data analysis, making implications on the relations to the workplace, and using them to conclude.

A good interpretation requires multitasking skillswhich involves listening, understanding, and communicating the message all at the same time. Hence, the interpreter must be practiced in cognitive and analytical skills keeping the deadline in mind. Through interpretation we can foster a greater cultural dialogue and we can exchange our cultural characteristics, so as to better understand our differences and finally find a way to use exactly these differences in order to achieve common goals.

The purpose of collection and interpretation is to acquire useful and usable information and to make the most informed decisions possible. Interpreting takes place in many settings and for many reasons, yet at heart the purpose of interpreting is to facilitate communication between parties who do not share a common language in the workplace. Trained, qualified interpreters faithfully interpret for all parties without adding, omitting or changing the message required in the workplace.

8.3 Writing information accurately

Workplace information must be written clearly, completely, and accurately according to the workplace requirement and to provide full information about the organization progress. Writing information accurately, clearly and concisely means that choosing your words deliberately and precisely, constructing your sentences carefully to express the workplace status.

During writing workplace information, consider the following points as a principle;

- Eliminate unnecessary phrases and redundancies.
- Use clear, simple and straightforward language for easy of understanding.
- Write in active voice.
- Shorten wordy phrases.
- Eliminate extra nouns for mitigating ambiguousness.

8.4 Identifying appropriate contact source of information

8.4.1 Establish appropriate contact with customers

Establish or build rapport or relationship means developing mutual trust, friendship and affinity with staff workers and customers or clients. Building rapport can be incredibly beneficial to employee career which helps them to establish good interpersonal relationships, and this can open many doors for them.

In a workplace, the following ways used to build or establish rapport with customers;

- Ask people their names.
- Be honest.
- Make recommendations.
- Be accommodating.
- Remember trust is a key to build rapport with customers.
- Be empathetic.
- Be a good listener.
- Learn to say sorry.

8.4.2 Sources of information

Sources of information or evidence are often categorized as primary, secondary, or tertiary material based on the originality of the material or source of information and the proximity of the source or origin. This informs the reader as to whether the author is reporting information that is first hand or is conveying the experiences and opinions of others that is considered second hand.

I. Primary Sources

These sources are records of events or evidence as they are first described or actually happened without any interpretation or commentary in the workplace. Primary sources display original thinking, report on new discoveries, or share fresh information.

II. Secondary Sources

These sources offer an analysis or restatement of primary sources and they often try to describe or explain primary sources. They tend to be works which summarize, interpret, reorganize, or otherwise provide an added value to a primary source.

III. Tertiary Sources

These are sources that index, abstract, organize, compile, or digest other sources. Some reference materials and textbooks are considered tertiary sources when their chief purpose is to list, summarize or simply repackage ideas or other information.

As information source for secondary and tertiary sources of information, the workplace may contact with;

A. **Suppliers and industry bodies:** The workplace should use machines, materials, and equipment in appropriate manner without having hazard.
B. **Local government and regulatory bodies:** The workplace should follow have license and registration of manufacturer /supplier, Pollution control board certificate of plan unit, and record of discharge effluent requirements.
C. **Trade personnel and training personnel:** The workplace should build the skill and capacity of employees in order to maximize its quality service.
D. **Contractors and advisers:** In order to be effective, the workplace should take suggestions and recommendation from concerned bodies like advisors.

8.5 Carrying out personal interaction

Communication is the process of exchanging information and information is conveyed as words, tone of voice, facial expression and body language. The Communication Process consists of these key elements;

- A message being sent (Message),
- Someone sending the message (Sender), and
- The receiver of the message (Receiver).

Another important element is the feedback cycle.

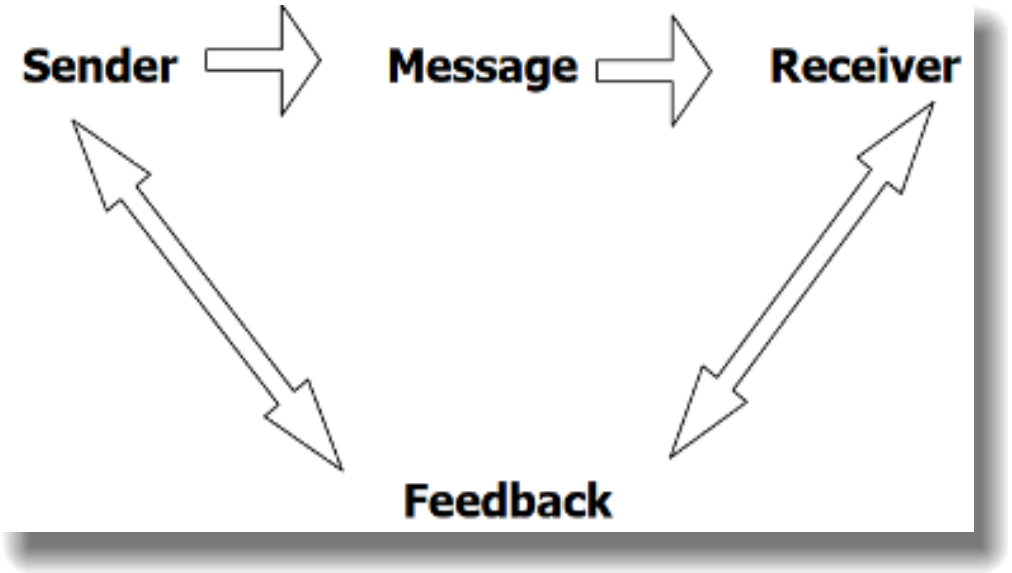

Figure 8.1 Communication Process key elements

When a person receives a message, he/she responds by a change in behavior (e.g. makes a verbal response, initiates an action, and uses facial expression or body language to indicate understanding). This is called feedback. Feedback let's you know that the message was received exactly as intended. The critical factor in measuring the effectiveness of communication is being sure that the message was understood.

Both the sender and receiver bring a combination of the following components to the communication process:

- Non-verbal behavior (facial expression, body stance, tone of voice, etc.)
- Expectations
- Senses (sight, touch, hearing, etc.)

- Abilities to talk or vocalize
- Brains (the storehouse of their knowledge and experiences)
- Environments (the settings in which they live and work.)
- General communication knowledge

An effective and efficient communication system requires managerial proficiency in delivering and receiving messages. A manager must discover various barriers to communication analyze the reasons for their occurrence and take preventive steps to avoid those barriers.

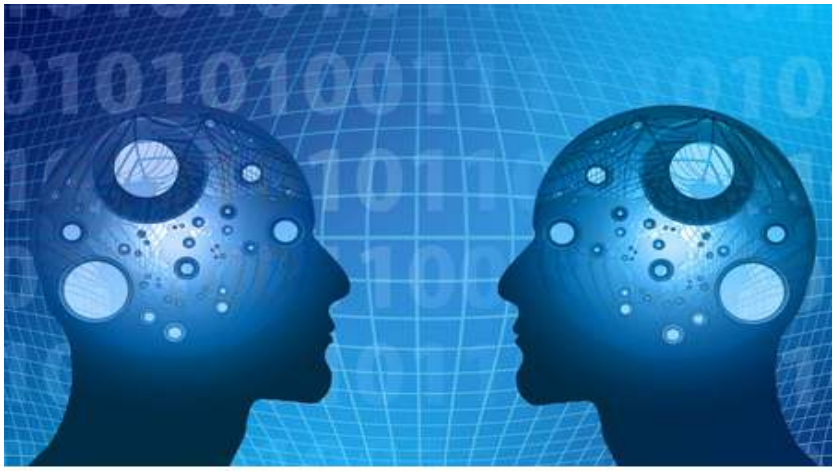

Figure 8.2 Effective communication or interaction

https://www.dhs.state.il.us/onenetlibrary/27896/documents/by_division/division%20of%20dd/directsupportperson/module4notebookhumaninteractionandcommunication.pdf

A manager should practice communication efficiently, effectively, responsively, courteously and supportively. Thus, the primary responsibility of a manager is to develop and maintain an effective communication system in the organization.

Figure 8.3 Using correct way of greeting and salutation

A manager should use correct forms of greeting, identification and address as required, and presenting the enterprise in a positive way is basic for effective communication and interaction.

Figure 8.4 Safe Greetings

https://www.learnenglish.de/basics/greetings.html

Figure 8. 5 Ways of greeting

Remember. . .

People will forget what you said.

People will forget what you did.

But, people will never forget how you made them feel!

Maya Angelou

Figure 8.6 Importance of Communication

https://www.youtube.com/watch?v=6xa9LUVw48I

The importance of communication in an organization can be summarized as follows:

- Communication promotes motivation,
- Communication is a source of information to the organizational members,
- Communication plays a crucial role in altering individual's attitudes,
- Communication helps in socializing.
- Communication assists in controlling process.

8.6 Defining workplace procedures and storage of information

8.6.1 Workplace procedures

A policy is a set of rules or guidelines for your organization and employees to follow in or to achieve compliance. Procedures explain the "how the workplace run activities." They provide step-by-step instructions for specific routine tasks. They may even include a checklist or process steps to follow.

Workplace procedures should outline the following information:

- Responsible person for each task.
- Steps need to be taken.
- Responsible or concerned body to report.

Good workplace procedure characterized by;

- Clear, concise, and simple language
- Addresses how to implement policies
- Takes user insight into account
- Providing options when feasible, not unnecessarily restrictive.

8.6.2 Workplace information storage

Data storage is the recording or storing of information in a storage medium. Data can be stored by or through;

I. Manual storage system

Manual storage systems are storage locations and racking systems which are not accessed by automated systems, but operated by humans. Forms of manual or paper based storage include;

- Filing cabinets,
- Lever arch binder,
- Suspension folders hanging files,
- Shelving.

II. Electronic information storage systems (Computerized system)

Computer data storage is a technology consisting of computer components and recording media that are used to retain digital data. Storage devices used in Computer storage systems include;

- Hard disk drive,
- Flash storage types,
- USB flash drive,
- SD Card,
- CD and DVD, etc.

Self-Check-8	Written test

Name: …… ID: …… Date: …….

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

Part I: Short Answer Questions (25 points)

1. List at least five important records maintained in the workplace. (5 points)
2. Write the meaning of specific and relevant information. (4 points)
3. Define data interpreting and write its importance. (5 pts**)**
4. Define rapport and write at least five ways of rapport building. (5 pts)
5. Mention types of information source and list data storage types. (3 pts)
6. Mention Communication Process key elements. (3 pts)

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

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