Alcoholic and Non Alcoholic Beverage Processing Level – II

Based on October 2019, Version 2 Occupational standards

MODULE TITLE: Preparing and operating waste water treatment operation process

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LG #45	LO#1-Prepare and operate waste water treatment operation process

Instruction sheet

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

- Confirming resource, chemicals and test equipment
- Confirming services
- Selecting, fitting and using personal protective equipment
- Conducting pre-operational checks
- Calibrating instrumentation and test equipment

Identifying and reporting hazards and maintenance requirementsThis 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:

- Confirm resource, chemicals and test equipment
- Confirm services
- Select, fit and use personal protective equipment
- Conduct pre-operational checks
- Calibrate instrumentation and test equipment
- Identify and report hazards and maintenance requirements

Learning Instructions:

Read the specific objectives of this Learning Guide.

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

Information Sheet 1- Confirming resource, chemicals and test equipment

1.1 Introduction

Wastewater refers to water that is no longer suitable for human consumption or for the purpose it was initially used for. When discharging wastewater into public sewers or into natural waters, legal limits for dissolved organic compounds must be respected depending on local conditions. In particular, the amount of organic matter detected as degradable COD (Chemical Oxygen Demand) is an important criterion. Due to the high oxygen consumption in its microbiological decomposition, increased organic load leads to a massive disturbance of the biological balance. If the specified limits are exceeded, usually high pollution surcharges accrue. Many companies in the industry therefore decide to invest in their own wastewater treatment securing their own standards of environmental awareness. Industrial wastewater treatment refers to processes which are used to treat wastewater that is produced by activities of an industrial firm. There are several types of wastewater treatment plants in operation. Industrial waste treatments necessarily requires the following types of resources, equipment and materials

1.2 waste water treatment system and related chemicals

For industrial companies producing wastewater as part of its process, some type of wastewater treatment system is usually necessary to ensure safety precautions and discharge regulations are met. The most appropriate industrial wastewater treatment system will help the facility avoid harming the environment, human health, and a facility's process or products (especially if the wastewater is being reused). It will also help the facility curb heavy fines and possible legal action if wastewater is being improperly discharged into a publicly owned treatment works (POTW) or to the environment.

An industrial wastewater treatment system might be made up of the technologies necessary to remove any number of the following:

Biochemical oxygen demand

Biochemical oxygen demand, or BOD, refers to the amount of dissolved oxygen needed by aerobic biological organisms to break down organic matter into smaller molecules. High levels of BOD indicate an elevated concentration of biodegradable material present in the wastewater and can be caused by the introduction of pollutants such as fecal waste, cleaning, and wash-down from beverage processing.

Nitrates and phosphates

If large amounts of nitrates and/or phosphates are not removed from wastewater and these nutrients are discharged into local environments, they can lead to an increase BOD and extensive weed growth, algae, and phytoplankton. This can further lead to eutrophication, or the deoxygenation in a body of water, killing the organisms and potentially leading to hypoxia or environmental dead zones.

Pathogens

Pathogens are bacteria, viruses, fungi, or any other microorganisms that can be present in wastewater that can lead to all kinds of health issues, including acute sickness, severe digestive problems, or death.

Metals

Mostly found in wastewater as a result of various industries, manufacturing processes, when left in wastewater in high concentrations, metals can cause extensive damage to the environment and human health. They are particularly damaging because they don't break down and tend to accumulate, causing toxic environs.

Total suspended solids

Total suspended solids (TSS) in wastewater, the organic and inorganic solid material suspended in the water, can, like many of the other contaminants listed, harm aquatic life. TSS can decrease levels of oxygen in aquatic environments and kill of insects. They can also scale and foul piping and machinery.

Total dissolved solids

Total dissolved solids (TDS) are any anions, cations, metals, minerals, or salts found in wastewater.

1.3.3 Wastewater treatment system work

Specific treatment processes vary, but a typical wastewater treatment facility process will usually include the following steps:

Coagulation

Coagulation is a process where various chemicals are added to a reaction tank to remove the bulk suspended solids and other various contaminants. This process starts off with an assortment of mixing reactors, typically one or two reactors that add specific chemicals to take out all the finer particles in the water by combining them into heavier particles that settle out. The most widely used coagulates are aluminum-based such as alum and polyaluminum chloride.

Sometimes a slight pH adjustment will help coagulate the particles, as well.

Flocculation

When coagulation is complete, the water enters a flocculation chamber where the coagulated particles are slowly stirred together with long-chain polymers (charged molecules that grab all the colloidal and coagulated particles and pull them together), creating visible, settleable particles that resemble snowflakes.

Sedimentation

The gravity settler (or sedimentation part of the wastewater treatment process) is typically a large circular device where flocculated material and water flow into the chamber and circulate from the center out. In a very slow settling process, the water rises to the top and overflows at the perimeter of the clarifier, allowing the solids to settle down to the bottom of the clarifier into a sludge blanket. The solids are then raked to the center of the clarifier into a cylindrical tube where a slow mixing takes place and the sludge is pumped out of the bottom into a sludge-handling or dewatering operation.

The dewatering process takes all the water out of the sludge with filter or belt presses, yielding a solid cake. The sludge water is put onto the press and runs between two belts that squeeze the water out, and the sludge is then put into a big hopper that goes to either a landfill or a place that reuses the sludge. The water from this process is typically reused and added to the front end of the clarifier.

Filtration

The next step is generally running the water overflow into gravity sand filters. These filters are big areas where they put two to four feet of sand, which is a finely crushed silica sand with jagged edges. The sand is typically installed in the filter at a depth of two to four feet, where it packs tightly. The feed water is then passed through, trapping the particles.

On smaller industrial systems, you might go with a packed-bed pressure multimedia filter versus gravity sand filtration. Sometimes, depending on the water source and whether or not it has a lot of iron, you can also use a green sand filter instead of the sand filter, but for most part, the polishing step for conventional wastewater treatment is sand filtration.

Disinfection

After the water flows through the gravity sand filter, the next step is typically disinfection or chlorination to kill the bacteria in the water.

Sometimes this step is done upstream before filtration so the filters are disinfected and kept clean. If your system utilizes this step prior to filtration, you will need to use more disinfectant .This way the filters are disinfected and kept free from bacteria (as well as the filtered water). When you add the chlorine up front you're killing the bacteria and have less fouling. If bacteria sits in the bed, you might grow slime and have to backwash the filters more often. So it all depends upon how you're system operates whether your system is set up to chlorinate upstream (prior to filtration) or downstream (after filtration).

1.3 Water testing equipment

Water quality-a term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.

The determination of wastewater quality based on environmental permits focuses on four major categories of laboratory tests.

Organics – determination of the concentration of carbon-based (i.e., organic) compounds aimed at establishing the relative "strength" of wastewater (e.g., Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Organic Carbon (TOC), and Oil and Grease (O&G)).

Solids – A measurement of the concentration of particulate solids that can dissolve or suspend in wastewater (e.g., Total Solids (TS), Total Suspended Solids (TSS), Total Dissolved Solids (TDS), Total Volatile Solids (TVS), and Total Fixed Solids (TFS))

Nutrients – A measurement of the concentration of targeted nutrients (e.g., nitrogen and phosphorus) that can contribute to the acceleration of eutrophication (i.e., the natural aging of water bodies)

Physical Properties and Other Impact Parameters – Analytical tests designed to measure a varied group of constituents directly impact wastewater treatability (e.g., temperature, color, pH, turbidity, odor).

1.3.1 Organic (carbon based) concentration taste

COD tester: used to test chemical oxygen demand of the water

Fig1 COD tester

Dissolved oxygen meter: Used to test to measure BOD5 or BOD of a water sample

Fig 2 Dissolved oxygen meter

1.3.2 Physical properties testers (color, turbidity, temperature, odor, PH)

Turbidity meter used to measure the turbidity of wastewater

Fig3 Turbidity meter

Total suspended meter: used to measure the amount of suspended solids of the waste water

Fig 4TSS meter

PH meter: used to measure the acid strength of the water

Fig5 PH meter with buffer solution

1.4 Waste water treatment Chemicals

1.4.1 Disinfectants

The three chemicals most commonly used as primary disinfectants are chlorine, chlorine dioxide and ozone. Mon chloramine, usually referred to as chloramine, is used as a residual disinfectant for distribution.

Chlorine(cl)

Chlorine is the most widely used primary disinfectant and is also often used to provide residual disinfection in the distribution system. Monitoring the level of chlorine in water entering a distribution system is normally considered to be a high priority (if it is possible), because the monitoring is used as an indicator that disinfection has taken place.

Chlorine dioxide

Chlorine dioxide breaks down to leave the inorganic chemicals chlorite and chlorate. These are best managed by controlling the dose of chlorine dioxide applied to the water

Mon chloramine

Mon chloramine, used as a residual disinfectant for distribution, is usually formed from thereaction of chlorine with ammonia. Careful control of monochloramine formation in water treatment is important to avoid the formation of di- and trichloramines, because these can cause unacceptable tastes and odors.

1.4.2 Coagulants

Chemicals used as coagulants include aluminium and iron salts, such as aluminium sulfate, polyaluminium chloride or ferric sulfate. Both substances can give rise to problems of discolouration and deposition of sediment in distribution if present in excessive amounts. The concentrations in water above which problems are likely to occur are 0.3 mg/l for iron and 0.2 mg/l for aluminium.

Sometimes organic polymers, known as coagulant aids, are used to assist with coagulation.

Dechlorinating chemicals

Dechlorinating chemicals are used to remove free residual chlorine during waste water treatment. Sulfur dioxide gas, and sodium bisulfite or sodium metabisulfite solutions are the main DE chlorinating chemicals.

Self-check 1	Written test

Name…………………………………………… ID……………………….. Date…….

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

Test I: Choose the best answer (4 point)

1. which one of the following is the importance of clarifiers

A. Discoloration B. precipitation C. condensation D. Settle suspended solids

2. Which one of the following chemicals used to adjust PH in water treatment system?

A. Chlorine B. Iron C sodium hydroxide D aluminum sulphat

3. Excess amount addition of aluminum and iron as a coagulant results________?

A. health problem B discoloration C. disposition of sediment D. B&C

4. Which one of the following is not disinfectant?

A. Ferric sulfate B. Ozone Chlorine D all

5. What makes water cloudy and opaque?

A. Dissolved solids B. Dissolved oxygen C. Salt D. Turbidity

Test II: Answer the following questions briefly

1. List the basic processes in water treatment system.(10pts)

____

2. What are the major laboratory tastes that determine the quality of water(10pts)

____

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

Note: Satisfactory rating - 15 points Unsatisfactory - below 15 points

Information Sheet 2 - Confirming services

Confirming services ready for operation

Confirming services readiness for waste water treatment operation involves the following tasks

- Identifying the required services and their availability
- Visual inspection
- Sorting and grading
- Equipment preparation

Services may include

- Power
- Compressed air

Power

Power availability, power reliability and power quality are essential for water treatment system.

Electrical power availability: capability of an electrical system to provide power with the proper quality for the powered equipment, yet often measured as an uptime rate over a defined period.

In order to operate an electrical installation, it is recommended that measurement of the main characteristics of the supply such as voltage, current, frequency, and/or active power are provided as a minimum.

Some electrical phenomena can have an impact on both installation assets and operations within a plant (e.g. unbalance can reduce the life time of machines, dips can stop a process, etc.)

Compressed air

Industrial water treatment is classic water treatment requiring aeration, agitation and continuous fluid movement.

There are three primary uses of compressed air in all wastewater treatment applications:

- Aeration to supply the processing bacteria with oxygen support
- Agitation to keep the solids in suspension and,
- A continuous, driving pump to move the material.

Air pressure required depends on:

- Liquid/slurry depth
- Actual water head pressure 2.31 feet equals 1 psig

There are many types of blowers (rotary vane, liquid ring, etc.) used in industry, particularly in the smaller sizes. As in most air and gas compression equipment, larger, well applied central units may well prove to be the most energy efficient solution when conditions dictate. Each opportunity needs a specific evaluation.

Self-check 2	Written test

Name…………………………………………… ID……………………….. Date…….

Directions: Answer all the questions listed below.

1. What are the main types of services required for waste water treatment?(5pts)
2. Where does compressed air is used in waste water treatment?(5pts)
3. What are the methods used to confirm waste water treatment?(5pts)

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

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

Information Sheet 3- Selecting, fitting and using personal protective equipment

Personal protective equipment, commonly referred to as "PPE", is equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses. These injuries and illnesses may result from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards. Personal protective equipment may include items such as gloves, safety glasses and shoes, earplugs or muffs, hard hats, respirators, or coveralls, vests and full body suits.

All personal protective equipment should be safely designed and constructed, and should be maintained in a clean and reliable fashion. It should fit comfortably, encouraging worker use. If the personal protective equipment does not fit properly, it can make the difference between being safely covered or dangerously exposed. When engineering, work practice, and administrative controls are not feasible or do not provide sufficient protection, employers must provide personal protective equipment.

Wastewater workers are exposed to different occupational hazards such as chemicals, gases, viruses, and bacteria. Personal Protective Equipment (PPE) is a significant factor that can reduce or increase the probability of an accident from hazardous exposures to chemicals and microbial contaminants.

At a minimum, workers and visitors should use nitrile gloves. When assigned tasks have the potential for contact with human waste, employees should consider double gloving with nitrile on the interior and thicker rubber gloves on the exterior. It is important to consider dexterity when selecting gloves. Employees typically won’t wear gloves that make work tasks difficult to perform.

- Because some pathogens can be absorbed by mucous membranes, face shields worn with safety glasses or goggles can help prevent splashes to the eyes, mouth, and nose.

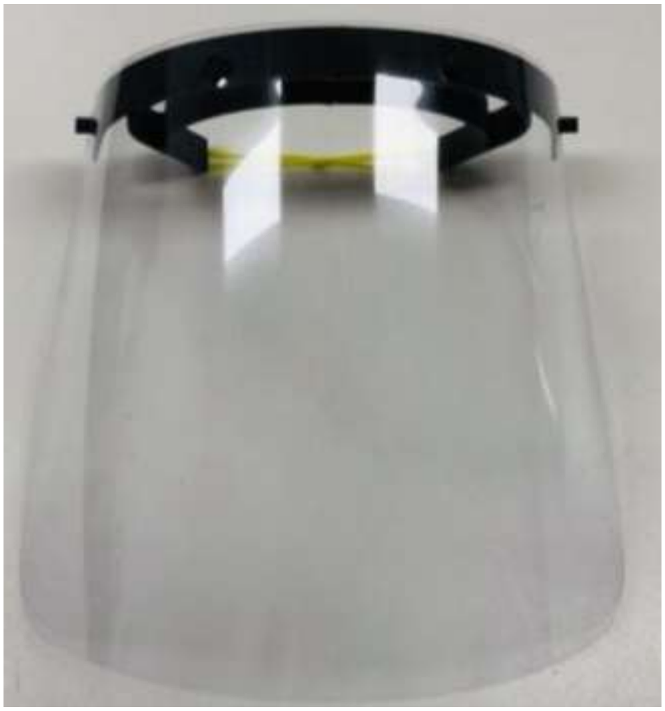


Fig9 face shields

Fig 10 glove

- At a minimum, respiratory protection such as filtering face pieces should be used where biosolids are aerosolized, as in the aeration and digestion process.
- In these facilities, workers walk over open tanks on catwalks. Hardhats and hearing protection will most likely be needed throughout the plant.

Fig 11 hardhat and hearing protection

- Steel-toed boots that are slip- and puncture-resistant will help protect feet.

Fig12protective shoes and cloth

Self-check 3	Written test

Name………………………………………… ID………………………… Date…….

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

Test I: Choose the best answer (4 point)

1. Personal protective equipments are the primary protections from workplace hazards.
   A. True B. False
2. When selecting PPE what kinds of conditions have to be considered?
   A. size B. safety C. exposure D. all

3. Face shields are not necessary for waste water treatment workers.

   A. True B. False

Test II: Short Answer Questions

1. List at list four types of WWT plant hazards(6pts)
2. List PPE and their importance.(12pts)

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

Note: Satisfactory rating - 15 points Unsatisfactory - below 15 points

Information Sheet 4-Conducting pre-operational checks

pre-operational checks

Pre-operational involves a daily check of the machines health. Any forklift or warehouse machine that needs repairs, maintenance or is observed to be unsafe to operate has to be taken out until such repair or maintenance has been done. Check to ensure there is a fire extinguisher, first aid kit, and any tools or supplies that you will need to perform your task.

A pre-start inspection involves a routine examination of a piece of equipment by its operator that is standardized via a checklist.

The purpose of an inspection is to identify whether work equipment can be operated, adjusted and maintained safely – with any deterioration detected and remedied before it results in a health and safety risk. The need for inspection and inspection frequencies should be determined through risk assessment.

The pre-operation inspection helps to:

1. Reduce the risk of injury due to defective equipment.
2. Verify that the equipment will operate in safe working order

Aside from being an OSHA(Occupational health and safety assurance) ,requirement, a pre-operational inspection helps to

- Reduces the risk of injury to you and other employees.
- Improves the condition of the lift truck.
- Increase productivity.
- Reduces downtime and maintenance costs.

A pre-start inspection involves a routine examination of a piece of equipment by its operator that is standardized via a checklist.

4.2 Pre-start check in Wastewater treatment

After having loaded the elements into the pressure vessels and before starting up the membrane unit, make sure that the whole pretreatment section is working in accordance with the specifications. If the pretreatment involved changing of the chemical characteristics of the raw water, then a full analysis of the water entering the membrane unit must be made. Furthermore, absence of chlorine, turbidity must be determined.

The raw water intake must be stable with respect to:

Flow	pH
Turbidity	Temperature
Bacteria (standard plate count)	

Pre-operational check

- Corrosion resistant materials of construction are used for all equipment from the supply source to the membrane including piping, vessels, instruments and wetted parts of pumps
- All piping and equipment is compatible with designed pressure
- All piping and equipment is compatible with designed pH range (cleaning)
- All piping and equipment is protected against galvanic corrosion
- Media filters are backwashed and rinsed
- New/clean cartridge filter is installed directly upstream of the high pressure pump
- Feed line, including RO feed manifold, is purged and flushed, before pressure vessels are connected
- Chemical addition points are properly located
- Check/anti-siphon valves are properly installed in chemical addition lines
- Provisions exist for proper mixing of chemicals in the feed stream
- Dosage chemical tanks are filled with the right chemicals
- Provisions exist for preventing the RO system from operating when the dosage pumps are shut down
- Provisions exist for preventing the dosage pumps from operating when the RO system is shut down
- If chlorine is used, provisions exist to ensure complete chlorine removal prior to the membranes
- Planned instrumentation allows proper operation and monitoring of the pretreatment and RO system

- Planned instrumentation is installed and operative
- Instrument calibration is verified
- Pressure relief protection is installed and correctly set
- Provisions exist for preventing the permeate pressure from exceeding the feed/concentrate pressure more than 5 psi (0.3 bar) at any time
- Interlocks, time delay relays and alarms are properly set
- Provisions exist for sampling permeate from individual modules
- Provisions exist for sampling raw water, feed, permeate and concentrate streams from each stage and the total plant permeate stream
- Pressure vessels are properly piped both for operation and cleaning mode
- Pressure vessels are secured to the rack or frame per manufacturer's instruction
- Precautions as given in Loading of Pressure Vessels are taken
- Membranes are protected from temperature extremes (freezing, direct sunlight, heater exhaust, etc.)
- Pumps are ready for operation: aligned, lubricated, proper rotation
- Fittings are tight
- Cleaning system is installed and operative
- Permeate line is open
- Permeate flow is directed to drain (In double-pass systems, provisions exist to flush first pass without permeate going through the second pass)
- Reject flow control valve is in open position
- Feed flow valve is throttled and/or pump bypass valve is partly open to limit feed flow to less than 50% of operating feed flow

Fig13 preoperational check

Self-check 4	Written test

Name…………………………………………… ID………………………… Date…….

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

Test II: Short Answer Questions

1. What is the purpose of conducting preoperational checks? (5pts)

____-

2. What is preoperational check? (5pts)

____

3. What is the requirement for raw water intake? (5pts)

4. List at least 10 waste water preoperational checks.(10pts)

____

____

5. What kinds of benefits does a worker gets in conducting preoperational check? (5pts)

____

____

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

Note: Satisfactory rating - 15 points Unsatisfactory - below 15 points

Information Sheet 5- Calibrating instrumentation and test equipment

5.1 Introduction

All testing instruments must be calibrated before they are used to measure the samples. For instrument probes that rely on the temperature sensor (pH, dissolved oxygen, specific conductance), each temperature sensor needs to be checked for accuracy against a thermometer that is traceable to the National Institute of Standards and Technology (NIST). Before any instrument is calibrated or used to perform measurements, the instrument must stabilize (warm-up) according to manufacturer's instructions and must have no air bubbles lodged between the probe and probe guard.

Most projects will require at least two standards to bracket the expected measurement range. This means that one standard is less than the expected value and one is higher. When an environmental sample measurement falls outside the calibration range, the instrument must be re-calibrated to bracket the new range before continuing measurements. Otherwise, the measurements that are outside the calibration range will need to be qualified.

5.2 Calibration procedures

Prior to calibration, all instrument probes and cable connections must be cleaned and the battery checked according to the manufacturer's instructions. Failure to perform these steps (proper maintenance) can lead to erratic measurements.

If a multi-probe instrument is to be used, program the instrument to display the parameters to be measured (e.g., temperature, pH, percent dissolved oxygen, mg/L dissolved oxygen, specific conductance.)

The volume of the calibration solutions must be sufficient to cover both the probe and temperature sensor (see manufacturer's instructions for the volume to be used). Check the expiration date of the standards. Do not use expired standards.

All standards are stored according to manufacturer instructions.

5.2.1 Temperature

Temperature sensor must be checked to determine its accuracy. This accuracy check is performed at least once per year and the accuracy check date/information is kept with the instrument. If the accuracy check date/information is not included with the instrument or the last check was over a year, the temperature sensor accuracy needs to be checked at the beginning of the sampling event. If the instrument contains multiple temperature sensors, each sensor must be checked.

Calibration Procedure

1. Fill a container with water and adjust the water temperature to below the water body's temperature to be measured. Use ice or warm water to adjust the temperature.
2. Place a thermometer that is traceable to the National Institute of Standards and Technology (NIST) and the instrument's temperature sensor into the water. Wait for both temperature readings to stabilize.
3. Compare the two measurements. The instrument's temperature sensor must agree with the reference thermometer measurement within the accuracy of the sensor (e.g., ±0.2°C). If the measurements do not agree, the instrument may not be working properly and the manufacturer needs to be consulted.
4. Adjust the water temperature to a temperature higher than the water body to be measured.
5. Compare the two measurements. The instrument's temperature sensor must agree with the reference thermometer measurement within the accuracy of the sensor (e.g., ±0.2°C). If the measurements do not agree, the instrument may not be working properly and the manufacturer needs to be consulted.

5.2.2 pH (electrometric)

The pH of a sample is determined electrometrically using a glass electrode.

Choose the appropriate buffered standards that will bracket the expected values at the sampling locations. If the water body's pH is unknown, then three standards are needed for the calibration: one close to 7, one at least two pH units below 7, and the other at least two pH units above 7. Instruments that will not accept three standards will need to be re-calibrated if the water sample's pH is outside the initial calibration range described by the two standards.

Calibration Procedure

1.Allow the buffered standards to equilibrate to the ambient temperature.

2. Fill calibration containers with the buffered standards so each standard will cover the pH probe and temperature sensor.

3.Remove probe from its storage container, rinse with deionized water, and remove excess water.

4.Select measurement mode. Immerse probe into the initial standard (e.g., pH 7).

5.Wait until the readings stabilize. If the reading does not change within 30 seconds, select calibration mode and then select “pH”. Enter the buffered standard value into instrument.

6.Remove probe from the initial standard, rinse with deionized water, and remove excess water.

7. Immerse probe into the second standard (e.g., pH 4). Repeat step 5.

8. Remove probe from the second standard, rinse with deionized water, and remove excess water. If instrument only accepts two standards, the calibration is complete. Go to step 11. Otherwise continue.

9. Immerse probe in third buffered standard (e.g., pH 10) and repeat step 5.

10. Remove probe from the third standard, rinse with deionized water, and remove excess water.

11. Select measurement mode, if not already selected. To ensure that the initial calibration standard (e.g., pH 7) has not changed, immerse the probe into the initial standard. Wait for the readings to stabilize. The reading should read the initial standard value within the manufacturer’s specifications. If not, re-calibrate the instrument. If re-calibration does not help, consult the manufacturer or replace the unit.

12. The calibration is complete. Rinse the probe with deionized water and store the probe according to manufacturer’s instructions.

13. Record the calibration information on .

5.2.3 Dissolved oxygen

Dissolved oxygen (DO) content in water is measured using a membrane electrode. To ensure proper operation, the DO probe’s membrane and electrolyte should be replaced prior to calibration for the sampling event. The new membrane may need to be conditioned before it is used; consult manufacturer's manual on how the conditioning is to be performed. Failure to perform this step may lead to erratic measurements. Before performing the calibration/measurements, inspect the membrane for air bubbles and nicks.

Note: Some manufacturers require an altitude correction instead of a barometric correction. In that case, enter the altitude correction according to the manufacturer's directions in Step 5 and then proceed to Step 6.

Note: Some instruments have a built-in barometer. Follow the manufacturer's instructions for entering the barometric value in step 5.

Calibration Procedure

1.Gently dry the temperature sensor and remove any water droplets from the DO probe's sensor membrane according to manufacturer's instructions. Note that the evaporation of moisture on the temperature sensor or DO probe may influence the readings during calibration.

2. Create a 100 percent water-saturated air environment by placing a wet sponge or a wet paper towel on the bottom of the DO calibration container. Place the DO probe into the calibration container. The probe is loosely fitted into the calibration container to prevent the escape of moisture evaporating from the sponge or paper towel while maintaining ambient pressure (see manufacturer's instructions). Note that the probe and the temperature sensor must not come in contact with these wet items.

3. Allow the confined air to become saturated with water vapor (saturation occurs in approximately 10 to 15 minutes). During this time, turn on the instrument to allow the DO probe to warm-up. Select the measurement mode. Check the temperature readings. Readings must stabilize before continuing to the next step.

4. Select calibration mode; then select "DO %".

5. Enter the local barometric pressure (usually in mm of mercury) for the sampling location into the instrument. This measurement must be determined from an on-site barometer. Do not use barometric pressure obtained from the local weather services unless the pressure is corrected for the elevation of the sampling location. [Note: inches

of mercury times 25.4 mm/inch equals mm of mercury or consult Oxygen Solubility at Indicated Pressure chart attached to the SOP for conversion at selected pressures].

6. The instrument should indicate that the calibration is in progress. After calibration, the instrument should display percent saturated DO

7. Select measurement mode and set the display to read DO mg/L and temperature. Compare the DO mg/L reading to the Oxygen Solubility at Indicated Pressure chart attached to the SOP. The numbers should agree. If they do not agree within the accuracy of the instrument (usually ± 0.2 mg/L), repeat calibration. If this does not work, change the membrane and electrolyte solution.

8.Remove the probe from the container and place it into a 0.0 mg/L DO solution (see footnote). Check temperature readings. They must stabilize before continuing.

9.Wait until the “mg/L DO” readings have stabilized. The instrument should read less than 0.5 mg/L (assuming an accuracy of ± 0.2 mg/L). If the instrument reads above 0.5 mg/L or reads negative, it will be necessary to clean the probe, and change the membrane and electrolyte solution. If this does not work, try a new 0.0 mg/L DO solution. If these changes do not work, contact the manufacturer. Note: some projects and instruments may have different accuracy requirements. The 0.5 mg/L value may need to be adjusted based on the accuracy requirements of the project or instrument.

10.After the calibration has been completed, rinse the probe with deionized water and store the probe according to manufacturer’s instructions. It is important that all of the 0.0 mg/L DO solution be rinsed off the probe so as not to effect the measurement of environmental samples.

11. Record calibration information on.

Note: You can either purchase the 0.0 mg/L DO solution from a vendor or prepare the solution yourself. To prepare a 0.0 mg/L DO solution, follow the procedure stated in Standard Methods (Method 4500-O G). The method basically states to add excess sodium sulfite (until no more dissolves) and a trace amount of cobalt chloride (read warning on the label before use) to water. This solution is prepared prior to the sampling event.

Note: This solution can be made without cobalt chloride, but the probe will take longer to respond to the low DO concentration.

5.3 Post calibration check

After the initial calibration is performed, the instrument's calibration may drift during the measurement period. As a result, you need to determine the amount of drift that occurred after collecting the measurements. This is performed by placing the instrument in measurement mode (not calibration mode) and placing the probe in one or more of the standards used during the initial calibration; for turbidity place the standard in a cuvette and then into the turbidimeter. Wait for the instrument to stabilize and record the measurement (Table 1). Compare the measurement value to the initial calibration value. This difference in value is then compared to the drift criteria or post calibration criteria described in the quality assurance project plan or the sampling and analysis plan for the treatment plant . If the check value is outside the criteria, then the measurement data will need to be qualified.

For the dissolved oxygen calibration check, follow the calibration instructions steps one through three while the instrument is in measurement mode. Record dissolved oxygen value (mg/L), temperature, and barometric pressure. Compare the measurement value to the Oxygen Solubility at Indicated Pressure chart attached to this SOP. The value should be within the criteria specified for the project. If measurement value drifted outside the criteria, the data will need to be qualified.

If sampling and analysis plan do not list the drift criteria or the post-calibration criteria, use the criteria below.

Measurement	**Post Calibration Criteria**
Dissolved Oxygen	± 0.5 mg/L of sat. value*
	< 0.5 mg/L for the 0 mg/L solution, but

not a negative value

PH	± 0.3 pH unit with pH 7 buffer*
Turbidity	± 5% of standard

Table 1

Instrument calibration lo

Project Name_______________ Date________________ Weather__________

Calibrated by_______________ Instrument___________

Serial Number_____

Parameters	Morning Calibration	Morning Temperature	End of Day Calibration Check*	End of Day Temperature
pH (7)				
pH (4))				
pH (10				
Dissolved Oxygen 100% water saturated air mg/L				
Dissolved Oxygen Zero Dissolved Oxygen Solution mg/L				
Turbidity Standard#1				
Turbidity Standard#2				
Turbidity Standard#3				

*For each Parameter, chose one standard as your check standard. If possible, choose the one that is closest to the ambient measurement value.

Information sheet6- Identifying and reporting hazards and maintenance requirements

6.1 Identifying hazards

Wastewater treatment workers treat sewer and storm water to remove impurities and then release the water to rivers, oceans, and for reuse station. Operators in wastewater plants use mechanical equipment, treatment tanks, and chemicals to clean the water.

Because there is so much water involved in the treatment process, slips, trips, and falls are the main hazard for wastewater treatment workers. Practice good housekeeping by sweeping up or squeegeeing water puddles. Mark areas that are prone to puddling. Fix leaks promptly. Use flooring surfaces that provide traction. Wear shoes that have a non-slip sole.

Confined spaces are a serious concern at water treatment facilities. Exposures to a low oxygen environment or high levels of hydrogen sulfide, methane gas, or ammonia can cause serious illness or death. Survey the areas for explosion potential from flammable gas and water engulfment in times such as heavy rain and flooding. Survey the entire facility for areas with limited egress and other hazard potential. Use proper confined space procedures, personal protective equipment (PPE), and ambient air and personal monitoring to ensure your safety.

Engulfment and/or drowning in treatment tanks are hazards at treatment plants. Put guardrails around all open water sources. Keep rescue equipment such as floats and hooks available near all tanks. If you will be doing work at height over an unguarded tank, consider fall protection gear and keep a coworker nearby to monitor you. When you lift grates over waterways and tanks for access, cordon off the area and place hazard warning signs to prevent accidental falls.

Water treatment plants have pumps and valves for moving water and many moving parts such as screens, belt presses, and conveyors remove debris and move sludge. This equipment can cause caught/crush hazards if you place a hand, arm, or foot too near a moving part. Guard all moving machinery and watch for these hazards while you work. Operating this equipment in a wet environment requires maintenance and repair work, so use good work practices. Electrical safety is key when working in a wet environment, so work carefully. Also follow lockout/tagout procedures to guard against accidental equipment startup while you are working on it.

Chemicals and biological hazards abound in water treatment. Use safety data sheets (SDS) to understand the properties, exposure limits, PPE, and emergency actions for your treatment chemicals. Good housekeeping controls odor and pests. Practice good hygiene by wearing gloves and washing your hands frequently. Decontaminate your clothing or change before you go home from work. Speak to your doctor and consider vaccination for some of the hazards that you may encounter.

Wastewater treatment can be a challenging work environment. Plants often operate continuously, so shift work and emergency work are common. Long work shifts wearing PPE can be tiring. To deal with the workload and job demands, get the rest you need and maintain your overall health.

6.2 Maintenance

Maintenance of the infrastructure: Ensuring the condition and operation of equipment and facilities which allows treatment with the inflow parameters determined by Legislation.

Maintenance requirements in waste water treatment

Preventive Electromechanical Maintenance: All operations that are carried out to maintain electrical and mechanical equipment in order to avoid breakdowns and stop pages, reduce corrective maintenance costs and process shutdowns.

Preventative maintenance and operating procedures that are necessary to ensure satisfactory operation, include:

- Operate gates through one cycle at least once a month
- Clean debris from the intake area when need arises or at least six times per year

Fine screens and micro strainers:

- Monitor head loss through screens continuously
- Lubricate bearings as scheduled
- Check cleaning systems periodically
- Remove screenings daily and dispose of it in an approved landfill.

Raw water meters must be calibrated so that an accurate indication can be obtained of the volume of water that is treated. This will also assist to optimize treatment processes.

Predictive Electromechanical Maintenance: Operations to control the condition of equipment operations in order to predict breakdowns and carry out a rapid repair following a failure. It is based on the ongoing understanding of the condition and operation of the facilities.

Corrective Electromechanical Maintenance: work to repair equipment, to detect an anomaly or stoppage of equipment and to return it to normal operations.

Metrological Maintenance: Regular calibration and adjustments to continuous measurement equipment and facilities' instrumentation.

Regulatory Maintenance: To comply with current regulation for specific equipment, carried out by specialist and authorized companies.

Analytical control: Understanding the parameter values for process waste water (influent, effluent, out-fall, sludge, etc.).

Note: Lack of maintenance is the most common reason for plant failure. Mechanical equipment requires regular attention to ensure problem-free operation. Maintenance schedules must be strictly carried out. Good housekeeping and keeping equipment, buildings and civil structures clean and tidy go a long way to minimise operational problems.

Self-check 6	Written test

Name... ID.......................... Date.......

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

Test I: Choose the best answer (4pts)

1. Engulfment/drowning hazard can be prevented by the following ways except.
   A. wearing Eye glass B. putting guardrails on open water source C. keeping rescue equipment available D. All
2. Which one of the following causes crushed / caught hazard?
   A .Mechanical equipment B. Screens C. Conveyers D. B&C E. None
3. The purpose of preventive electromechanical maintenance is _____________?
   A. Avoiding break down B. Reduce corrective maintenance cost
   C. process shut down D. All E. None

Test II: Short Answer Questions

1. List confined spaces which may result serious illness or death to the water treatment worker. (5pts)

____

2. What are the chemicals that cause chemical hazards in waste water treatment plant? (10pts).

____

3. What is maintenance? (5pts)
4. List maintenance requirements in waste water treatment (8pts)

____

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

Note: Satisfactory rating - 20 points Unsatisfactory - below 20 points

Operation Sheet 1-calibrating thermometer

Thermometer calibrating procedure

1. Fill a container with water and adjust the water temperature to below the water body's temperature to be measured. Use ice or warm water to adjust the temperature.

2. Place a thermometer that is traceable to the National Institute of Standards and Technology (NIST) and the instrument's temperature sensor into the water. Wait for both temperature readings to stabilize.

3. Compare the two measurements. The instrument's temperature sensor must agree with the reference thermometer measurement within the accuracy of the sensor (e.g., ±0.2°C). If the measurements do not agree, the instrument may not be working properly and the manufacturer needs to be consulted.

4. Adjust the water temperature to a temperature higher than the water body to be measured.

5.Compare the two measurements. The instrument's temperature sensor must agree with the reference thermometer measurement within the accuracy of the sensor (e.g., ±0.2°C). If the measurements do not agree, the instrument may not be working properly and the manufacturer needs to be consulted.

Operation Sheet 2-calibrating PH meter

PH meter calibrating procedures

1. Allow the buffered standards to equilibrate to the ambient temperature.

2. Fill calibration containers with the buffered standards so each standard will cover the pH probe and temperature sensor.

3.Remove probe from its storage container, rinse with deionized water, and remove excess water.

4.Select measurement mode. Immerse probe into the initial standard (e.g., pH 7).

5.Wait until the readings stabilize. If the reading does not change within 30 seconds, select calibration mode and then select “pH”. Enter the buffered standard value into instrument.

6.Remove probe from the initial standard, rinse with deionized water, and remove excess water.

7. Immerse probe into the second standard (e.g., pH 4). Repeat step 5.

8. Remove probe from the second standard, rinse with deionized water, and remove excess water. If instrument only accepts two standards, the calibration is complete. Go to step 11. Otherwise continue.

9. Immerse probe in third buffered standard (e.g., pH 10) and repeat step 5.

10. Remove probe from the third standard, rinse with deionized water, and remove excess water.

11. Select measurement mode, if not already selected. To ensure that the initial calibration standard (e.g., pH 7) has not changed, immerse the probe into the initial standard. Wait for the readings to stabilize. The reading should read the initial standard value within the manufacturer’s specifications. If not, re-calibrate the instrument. If re-calibration does not help, consult the manufacturer or replace the unit.

12. The calibration is complete. Rinse the probe with deionized water and store the probe according to manufacturer’s instructions.

13. Record the calibration information

LAP TEST 1	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 hour. The project is expected from each student to do it.

Task1. Calibrate Thermometer

Task2. Calibrate PH meter

LG #46	LO#2: Operate and monitor the waste water treatment process

Instruction sheet

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

- Starting waste water treatment
- Confirming operating condition
- Monitoring, testing and adjusting waste water operations
- Operating first flush systems
- Ensuring the work area

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:

- Start waste water treatment
- Confirm operating condition
- Monitor, test and adjust waste water operations
- Operate first flush systems
- Ensure the work area

Learning Instructions:

Read the specific objectives of this Learning Guide.

1. Follow the instructions described below.
2. Read the information written in the "Information Sheets". Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
3. Accomplish the "Self-checks" which are placed following all information sheets.
4. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).

5. If you earned a satisfactory evaluation proceed to “Operation sheets
6. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
7. If your performance is satisfactory proceed to the next learning guide,
8. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information sheet 1 –starting waste water treatment

1.1 Preliminary treatment

Preliminary treatment plant is the equipment and facilities used to remove items such as rags, grit, sticks, other debris, and foreign objects.

Upon arrival via the sewer system, the wastewater is sent through a bar screen, which removes large solid objects such as sticks and rags. Leaving the bar screen, the wastewater flow is slowed down entering the grit tank, to allow sand, gravel and other heavy material that was small enough not to be caught by the bar screen to settle to the bottom. All the collected debris from the grit tank and bar screen is disposed of at a sanitary landfill

Fig 14Bar rack

Fig15 A coarse screen

Purpose of bar rack and coarse screen

- remove larger objects
- Solid material stored in hopper and sent to landfill
- Mechanically or manually cleaned

1.1.1 Grit removal

Grit represents the heavier inert matter in wastewater which will not decompose in treatment processes. It is identified with matter having a specific gravity of about 2.65,and design of grit chambers is based on the removal of all particles of about 0.011 inch or larger (65 mesh).

Grit removal, compared to other unit treatment processes, is quite economical and employed to achieve the following results:

- Prevent excessive abrasive wear of equipment such as pumps and sludge scrapers.
- Prevent deposition and subsequent operating problems in channels, pipes, and basins.
- Prevent reduction of capacity in sludge handling facilities.
- remove inert dense material, such as sand, broken glass, silt and pebbles

Fig15 Grit chambers

1.1.2 Pre-aeration.

Methods of introducing supplemental oxygen to the raw wastewater are sometimes used in preliminary treatment. This process is known as preaeration

The objectives of pre- aeration:

- Improve wastewater treatability.
- Provide grease separation, odor control, and flocculation.
- Promote uniform distribution of suspended and floating solids to treatment units.
- Increase BOD removals in primary sedimentation.

This is generally provided by either separate aeration or increased detention time in an aerated grit chamber. Provisions for grit removal are provided in only the first portion of the tank

1.1.3 Equalization.

Equalization reduces fluctuations of the influent to levels compatible with subsequent biological or physical-chemical processes. While there are definite primary benefits for equalization, a facility can also be designed to yield secondary benefits by taking advantage of physical, chemical, and biological reactions which might occur during retention in the equalization basin. For example, supplemental means of aeration are often employed with an equalization basin to provide:

- Better mixing.
- Chemical oxidation of reduced compounds.
- Some degree of biological oxidation.
- Agitation to prevent suspended solids from settling and prevent odors

If aeration is not provided, baffles or mechanical mixers must be provided to avoid stratification and short circuiting in equalization basins. The size and shape of an equalization facility will vary with the quantity of waste and the patterns of waste discharge. Basins should be designed to provide adequate capacity to accommodate the total volume of periodic variation from the wastewater source.

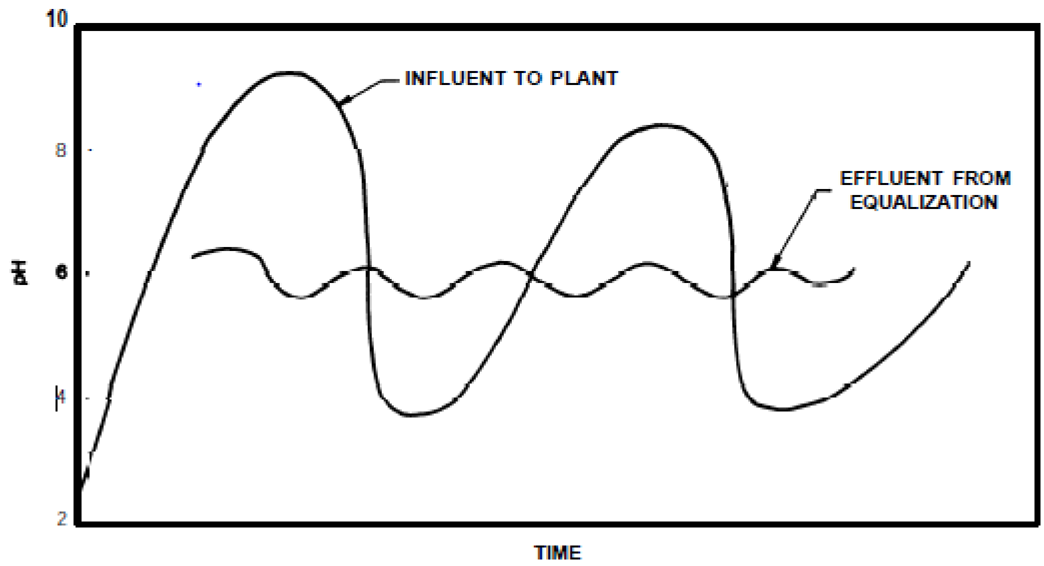


Fig 16 the effect of equalization on a wastewater with variable PH

Equalization basin purpose

- To dampen the variation in wastewater flow into a WWTP
- To Improves effectiveness of primary & secondary treatment
- Usually achieved by large basins to collect wastewater and pumped to treatment plant at a constant rate

1.1.5 pH control.

It is necessary to regulate pH since treatment processes can be harmed by excessively acidic or basic wastes. Regulation of this parameter may be necessary to meet effluent levels specified for secondary treatment. Control of the pH at elevated levels is usually required to precipitate certain heavy metals and/or alleviate an odor producing potential.

1.1.6 Flotation.

In preliminary treatment, flotation is sometimes used for wastes which have heavy loads of grease and finely divided suspended solids.

Use of air to float materials may relieve scum handling in a sedimentation tank and lower the grease load to subsequent treatment units. Grit removal is often incorporated with a flotation unit providing sludge-removal equipment.

1.1.7 Other methods

Other preliminary treatment steps include coagulation and chlorination. Chlorine additions are often made to the plant influent for odor control. Two other operations which usually precede any treatment process include pumping and flow measurement. Wastewater bypasses must also be provided.

1.2 Primary treatment (Sedimentation)

Primary treatment is the second step in wastewater treatment. It allows for the physical separation of solids and greases from the wastewater. The screened wastewater flows into a primary settling tank where it is held for several hours allowing solid particles to settle to the bottom of the tank and oils and greases to float to the top.

Primary treatment with chemical addition to sedimentation is preferred for industrial waste water treatment.

Sedimentation with chemical coagulation

Sedimentation using chemical coagulation has been implied mainly to pretreatment of industrial or process wastewaters and removal of phosphorus from domestic wastewaters

Advantages of sedimentation facilities are:

- A decrease in organic loading to secondary treatment process units.
- A decrease in quantity of secondary sludge produced.
- An increase in quantity of primary sludge produced which can be thickened and dewatered more readily than secondary sludge.

Chemicals commonly used, either singularly or in combination, are the salts of iron and aluminum, lime, and synthetic organic polyelectrolytes. It is desirable to run jar studies to determine the optimal chemicals and dosage levels.

Fig17 primary settling basin

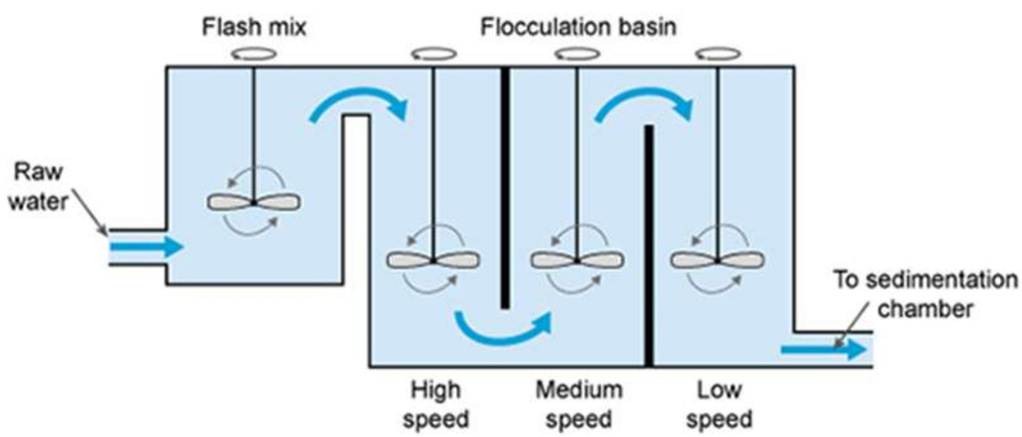


Fig 18 primary treatment

1.3 Secondary treatment (Biological Wastewater Treatment Processes)

Biological secondary treatment processes remove the soluble solids as they are absorbed into the cells of microorganisms. These microorganisms also remove suspended solids by first adsorbing the solids onto the outside of the cell. An enzyme is then secreted which breaks the solids down into soluble matter which can be absorbed by the cell.

There are many alternative systems in use and each uses biological activity in different manners to accomplish treatment. Biological processes are classified by the oxygen dependence of the primary microorganism responsible for waste treatment. In aerobic processes, waste is stabilized by aerobic and facultative microorganisms; in anaerobic processes, anaerobic and facultative microorganisms are present

- Basic aerobic biological treatment is shown by the following equation

$$\text{Organic matter} + O_2 \xrightarrow{\text{microorganisms}} CO_2 + \text{new cells}$$

- mixing of water to solids containing that use oxygen to consume the remaining organic matter in the wastewater as their food supply (use of air bubble for mixing and oxygen supply)
- liquid mixture (i.e., solids with micro-organisms and water) is sent to the final clarifier.
- In clarifier, solids settle out to the bottom where some of the material is sent to the solids handling process and some is recycled back to replenish the population of micro-organisms in the aeration tank to treat incoming wastewater.

1.4 Final treatment (disinfection)

After going through all the processes, you can still find some diseases causing organisms. To complete eliminate and remove all these organisms, wastewater is then disinfected for about 20-25 minutes inside those tanks that have the mixture of sodium hypochlorite and chlorine.

Treated water is disinfected and then it is send out for wastewater reuse activities or for discharging in river/streams

1.5 Solids processing (sludge treatment)

Means a semi liquid waste with a solid concentration in excess of 2500 parts per million obtained from the treatment of wastewater.

The produced and collected sludge at the primary and secondary levels requires a high concentration and thickening process. This is achieved by putting them into the thickening tanks then let it to settle down and then separate it later from the water.

Fig 19 waste water treatment plant

In short beverage waste water treatment operation works as follow

1. Wastewater flows off the production floor and into some sort of collection basin. From there it is screened to remove any coarse or heavy solids that could damage process pumps.
2. After passing through the screening equipment, wastewater is collected and blended together to form a homogenous solution. This is called *Equalization*.
3. From the EQ tank, wastewater is pumped into a flocculator for chemical treatment. Dosing pumps meter pH reagents, coagulants, and flocculants into the flocculator to help agglomerate solid materials into large, floatable flocs.
4. Water then flows into a dissolved Air Flotation (DAF) unit where the physical separation takes place.
5. Separated solids flow out of the DAF system as sludge. Depending on the nature of the removed solids, various sludge management options are considered.
6. Clarified water flows out of the DAF unit onto further processing or for discharge.

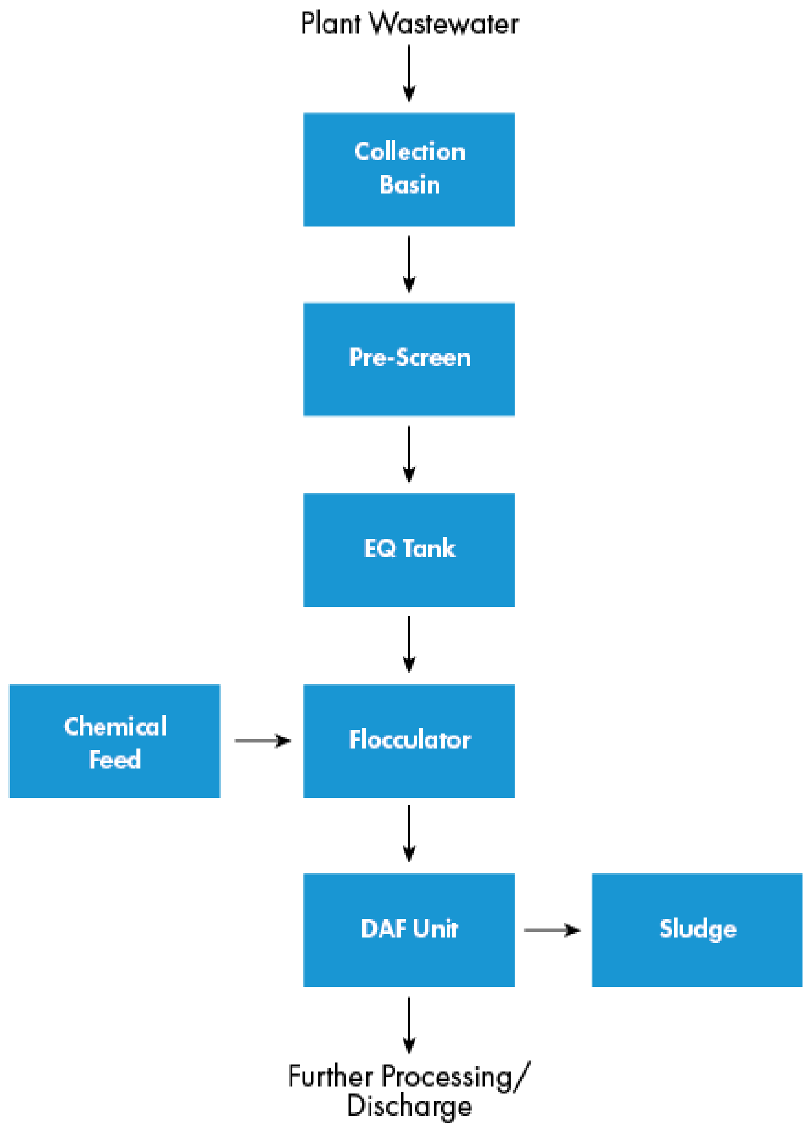


Fig 20process flow diagram Waste water plant

Self-Check – 1	Written test

Name…………………………………………… ID………………………… Date……

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

Test I: choose the best answer (3pts)

1. Which one of the following is not preliminary waste water treatment?

A. sedimentation B. Grit removal C. Screening D. None

2. Pre-aeration and grit removal are the same.

A. True B true

3. All of the following are the purpose of pre-aeration

A .improving waste water treatability B. provide grease separation C. removal Of rags D. None

4. The disinfecting time for waste water treatment is _______________?

A. 40 minute B. 120 minute C. 24 minute D.60 minute

5. Among the following chemicals which one is used for sedimentation?

A. Monochloroamide B. Sodium hydroxide C. Ozone D. salt of Iron

Test II: Answer briefly the following questions (10pts)

1. List and explain the types of treatments that are included under preliminary waste water treatment.
2. Identify the purpose of primary waste water treatment.
3. Explain and Show how aerobic biological waste water treatment is conducted
4. Show process flow diagram of waste water treatment.
5. Explain sludge treatment process. (5pts)

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

***Note:* Satisfactory rating - 25 points Unsatisfactory - below 25 points**

InformationSheet3- Monitoring, testing and adjusting waste water operations

Most industrial water treatment systems are dynamic. They constantly undergo changes because of seasonal variations in water chemistry, varying plant operating conditions, new environmental laws, and other factors. Because of this, proper monitoring is essential to ensure that the water treatment program applied to a boiler, cooling, wastewater or other industrial water system is satisfactorily controlled so that the desired results are achieved.

Some of the value added benefits obtained through proper monitoring of a water treatment program include:

- reduced risks associated, with chemical underfeed or overfeed
- continuing compliance with environmental regulations
- improved quality of plant operation
- increased water and energy savings
- improved plant productivity

Industrial water treatment systems may be monitored by the following methods

- Manual monitoring
- Continuous, on-line monitoring

MANUAL MONITORING

Manual monitoring typically involves plant operators or technicians conducting chemical tests and comparing the results to specified chemical control limits. The testing frequency can vary from once per day to once per hour, depending on the plant resources available. The tests run can include pH, conductivity, suspended solids, alkalinity, hardness, and others. Using the test results, the plant operator manually adjusts a chemical feed pump or blowdown valve, making an estimate of the degree of change necessary.

Wastewater quality requirements for re-use and discharge must be as given inTable1

All Units are mg/l unless otherwise stated		
Parameter	Limits (not greater than)	
	Maximum	Monthly average over any four consecutive weeks
PHYSICAL		
Total Dissolved Solids	1500	1000
Total Suspended Solids	15	10
Turbidity (NTU.)	5	2
Chemical		
Aluminum	5	1
Chemical Oxygen Demand	100	50
Dissolved oxygen	2min	2min
Chloride	350	250
Chlorine, free residual (after 60min contact time)	0.5 min	0.5min
Biochemical oxygen demand(BOD)	15	10
Iron	5	1
Magnesium	150	30
Total Organic Carbon	50	20
Sodium	200	70
Organic Nitrogen (Kjeldahl)	10	5
PH (PH unit)	6-9	6-9
Copper	0.3	0.2
Chromium	0.5	0.1

Continuous /online monitoring

Because of the dynamic nature of many water treatment systems and the worldwide need for improved reliability and quality, a higher degree of precision is required in the monitoring and control of water treatment process than that obtained through manual monitoring. To achieve the degree of precision needed, continuous on-line monitoring with automatic instrumentation is required.

Because of the many technological develop" meets in electronics and microprocessor technology over the last decade, there is a wide range of instrumentation available to monitor water treatment systems. The following sections address the systems available to monitor conductivity. pH, corrosion rate, turbidity, dissolved oxygen. sodium, fouling, biological activity, and halogens.

Fig21 Continuous multipara meter process monitoring and control

First flush refers to the idea that the first 10ml of rain falling is considered to be contaminated. This water picks up any residue of oil, sludge, soaps and detergents on the ground surface. It may also contain amounts of bacteria from decomposed insects, lizards, bird and animal droppings and concentrated tannic acid, sediments, water borne heavy metals and chemical residues, all of which are undesirable elements. It must be routed to a water treatment process like an oil water separator before discharging into a trade waste sewer.

All rainwater falling after the first 10 ml is considered clean and can be routed directly to the storm water network. In this way, no contaminants are released into the environment, which could cause harm to plants and fish.

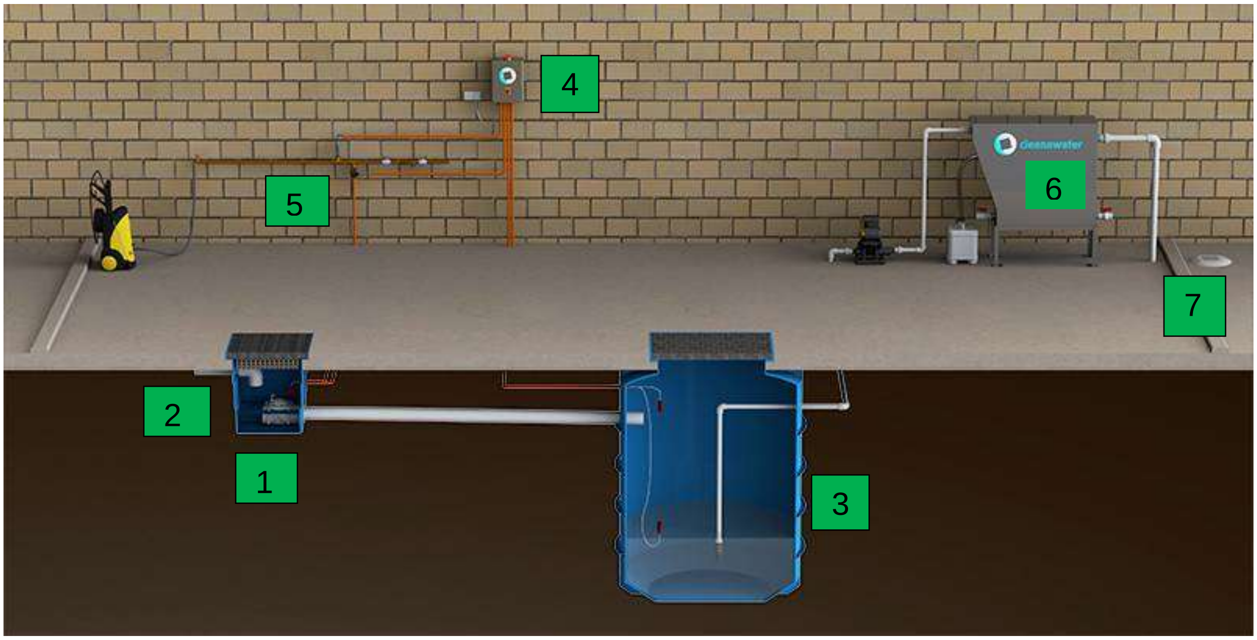
Another benefit relates to wastewater treatment plants. These plants have defined capacities based on the expected wastewater volumes. Rainwater will overload treatment plants causing them to release contaminated water into the environment.

4.2 First flush diversion work

Rain is measured using a rain gauge, which keeps the diverter valve open to the wastewater treatment process until the prescribed volume of rain has fallen. At this point, the diverter valve is shut off and all rainwater overflows into the stormwater system until the valve reactivates.

Fig22 First Flush Diversion System

A rain gauge will measure the first 10mm of rainwater and will divert this amount onto the water treatment system. Once 10mm of rainwater is reached, the gauge will send a signal to the controller and allow further rainwater to be discharged to the storm water system.



Number	Description
1	All waste water is directed to the Diversion Pit
2	Diversion valve shuts allowing discharge to storm water after 10mm or programmed rainfall amount is exceeded
3	Diversion valve open allows contaminated water to flow into main collection pit for further treatment and discharge to authorised discharge point
4	Control panel controls the actuation of the diversion valve and/or treatment system if applicable
5	Water connection manifold is connected to the diversion valve enabling open/close operation. Valve is electrically or pneumatically actuated depending on the application
6	Oil separator treats contaminated water prior to discharge. Commonly

	paired with diversion systems for a total water treatment solution
7	Water is treated and discharged to sewer or approved discharge point

Information Sheet 5- Ensuring the work area

A clean workplace is necessary for a safe work environment – accidents and injuries are avoided and productivity is improved where good housekeeping is a daily occurrence. Such procedures will help promote the best use of limited space, keep material storage to a minimum, decrease energy costs, and minimize property damage.

The Occupational Safety and Health Administration, or OSHA, provides regulations for industrial housekeeping standards. These standards are designed to ensure safety and minimize the potential of spreading disease. OSHA provides general standards for all industries in the OSHA Standard Regulations.

Walkways

OSHA's general housekeeping standards require businesses to maintain a clean and sanitary work environment. All hallways, aisles and walkways must be kept dry and free of clutter to reduce the potential for falls and injuries. Hallways and walkways must be kept in good repair and no protruding nails or splints should be present.

Chemicals

OSHA requires industries that deal with chemicals or hazardous liquids to store and secure the chemicals properly. Each container should be properly labeled for easy and accurate identification. The workplace must provide a hazardous communication program which includes material safety data sheets, training and proper warning labels. Industries subject to these standard regulations include chemical production factories and manufacturers, maritime and agricultural industries and food and liquor industries, such as restaurants and bars.

Pathogens

All pathogens must be treated as if they are contaminated with infectious diseases. The industries must have an exposure control plan that explains the strategies and procedures used to control and contain the pathogens. The workplace must provide employees with protective gear and sanitizing chemicals to clean the pathogenic area.

The facility must provide an easily accessible hand-washing station stocked with antiseptic cleaner and paper towels.

LG#47	LO3: Analyze and respond to abnormal performance

Instruction sheet

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

- Analyzing water and plant operating conditions
- Taking corrective actions of hazards and out-of-specification
- Typical Causes of non-confirming water quality and corrective action
- Water quality sampling and testing procedures
- Implementing emergency procedures

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:

- Analyze water and plant operating conditions
- Take corrective actions of hazards and out-of-specification
- Typical Causes of non-confirming water quality and corrective action
- Water quality sampling and testing procedures
- Implementing emergency procedures

Learning Instructions:

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5. If you earned a satisfactory evaluation proceed to "Operation sheets

6. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
7. If your performance is satisfactory proceed to the next learning guide,
8. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information sheet 1- Analyzing water and plant operating condition

1.1 Analyzing water condition and plant operating conditions

Testing for proper pH level, ammonia, nitrates, phosphates, dissolved oxygen, and residual chlorine levels to conform to the plant's National Pollutant Discharge Elimination System (NPDES) permit are critical to the plant's performance.

Although testing is continuous throughout the wastewater treatment process to ensure optimal water flow, clarification and aeration, final testing is done to make sure the effluent leaving the plant meets permit specifications. Plants that don`t meet permit discharge levels are subject to fines and possible incarceration of the operator in charge.

During treatment, the pH is reduced because of the reaction between the coagulant and the alkalinity of the raw water. To avoid corrosion in the distribution system, the pH must be adjusted upwards (usually with lime) before treated water is discharged from the plant - but this can conflict with disinfection. Measurements of pH should be made routinely (and recorded) for raw water, settled water, filtered water and water discharged to the distribution system.

Most treatment plants do not routinely adjust the pH for coagulation except if additional alkalinity is essential for the reaction to proceed. The coagulant dose to produce a good settle able flock is usually determined in the laboratory and through experience. The main reason for this practice is convenience - the pH may not be optimum but in the opinion of the operators it may be satisfactory.

Water departments should maintain at least a basic set of equipment and reagents which can be used by appropriately-trained personnel to measure accurately the physical, chemical and biological characteristics of raw and treated water. Complete and accurate information is an essential element of water quality monitoring and of the design of treatment plant improvements.

Information sheet 2:taking corrective on hazards and out of specification

2.1 Identifying hazard

Workers in the wastewater treatment sector are responsible for the day-to-day operation, maintenance, trouble-shooting and handling of special problems of municipal, industrial, and other wastewater treatment plants.

There are also risks of injury to the head, feet, hearing including crush injuries, lacerations.

There may be injuries by slips, trips and falls on wet floors; by falls into treatment ponds, pits, clarifiers or vats and by splashes of hazardous liquids; they may suffer cuts and pricks from sharp tools, contusions, etc.

There is also exposure to hazards related to work in confined spaces. Strains and sprains are the most common types of injuries.

Exposure to toxic substances, pathogens and other hazardous materials can have a significant long-term impact on workers and their families with many workers experiencing lifelong disabilities. The three primary types of exposure risks are:

Biological

There is a high potential for illnesses arising from contact with viruses, bacteria and other microorganisms in sewage.

The most serious viral risk is hepatitis. The most serious bacterial risk is tetanus.

The main routes of exposure are hand-to-mouth contact. Breathing in a suspension of particles (aerosols) is a less common means of exposure but may occur whenever sewage is agitated or aerosolized. This occurs most commonly near incoming wastewater inlets and sludge treatment areas.

Chemical

Confined spaces containing sewage can sometimes be deficient in oxygen due to organic oxidation and displacement by carbon dioxide. They can also contain flammable gases such as methane and toxic gases such as carbon monoxide and hydrogen sulphide. Carbon monoxide, carbon dioxide, and other exhaust gases may sometimes be present due to a poorly located gasoline engine or generator exhausting into the confined space. Chloroform is a common byproduct of disinfection.

Metals

Metals are generally not air-stripped into the air in sufficient quantities to be significant (with the exception of mercury). Therefore, they accumulate either in sludge or pass through into the receiving water.

Control of hazardous energy Involves more than just applying A LOCK AND/OR TAG to a power switch. All residual energy must be isolated or brought to the ground state.

Residual energy may be present in motor capacitors, air lines, fluid power (hydraulic) systems and mechanical apparatus. Pressure can develop in lines from continuing biological processes generating gasses.

2.2 Typical Causes of nonconforming water quality and corrective action

Typical causes of nonconforming water quality can be broadly lumped into four basic classes Organic contaminants, Inorganic contaminants, Pathogens, and Other contaminants

Beverage wastewater consists of wasted nonalcoholic beverage and syrup, water from the washing of bottles and cans, which contains detergents and caustics, and finally lubricants used in the machinery, water from production of malt.

Winery wastewater comes from a number of sources that include:

- cleaning of tanks
- ion exchange columns
- hosing down of floors and equipment
- rinsing of transfer lines
- spent wine and product losses
- bottling facilities
- filtration units
- laboratory wastewater.
- storm water diverted into or captured in the wastewater management system

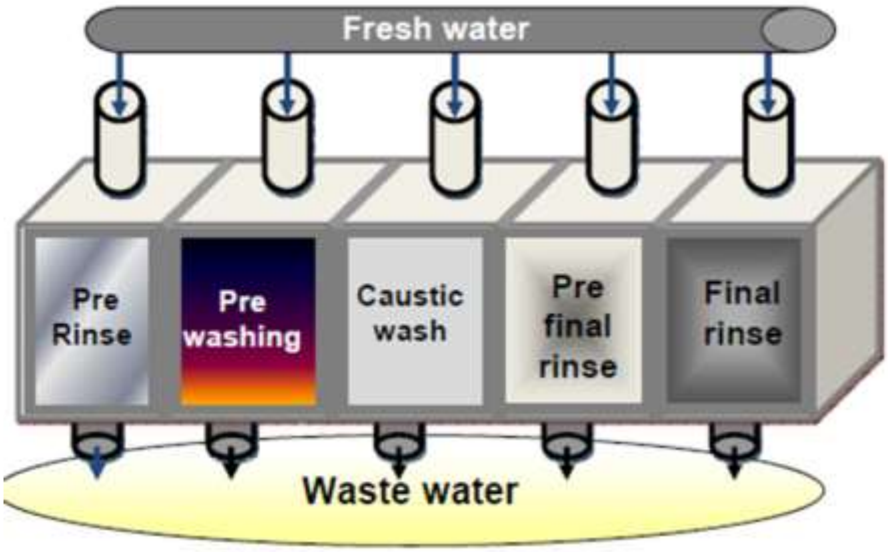

Fig 23 schematic diagram of bottle washing unit

The corrective actions for beverage industry waste are maintaining the standard level of PH, odor, TSS, BOD ,color of the water the specification for the listed parameters has been discussed earlier if it is out of the specifications use sodium hydroxide to adjust PH, use aluminum based such as alum, polyaluminum chloride.

For dechlorinating purpose (if the amount of free chlorine is in excess)

Use Sulfur dioxide gas, and sodium bisulfite or sodium met bisulfite solutions as dechlorinating chemicals.

2.3 Water quality sampling and testing procedures

2.3.1 Introduction

The reliability of numbers generated by any analytical procedure relies to a great extent upon the sampling used. If the sample collected does not represent the flow or process sampled, the laboratory results will be almost meaningless.

Sampling devices and containers must be kept clean, and automatic composite samplers must have a flow velocity great enough to prevent solids from settling out in the sampling changer or sample collection line.

If samples are to be stored for a period of time before analysis it is important that proper storage and preservation procedures are implemented. These procedures usually include refrigeration of the sample both during (in the case of composite samples) and after collection, to slow biological activity.

2.3.2 Sampling procedure

Various types of samples can be taken according to the requirements of the specific monitoring plan. Thorough consideration of the objectives of the sampling plan should occur before deciding on the types of samples to be taken. If an inappropriate type of sample is collected the water quality data gained may not provide the information desired.

Grab samples

Grab samples are discrete samples that are taken at a location to provide a 'snapshot' of the water quality characteristics at that time. For the purposes of quantifying water or wastewater constituents, grab samples will show the concentrations at that location and time of sampling.

They will not provide any information about the concentrations outside that point in time. As such, if grab samples are employed, a high number of samples (high sampling frequency) may be required to show the nature of change over time. A sampling plan using grab samples could show the dispersal of discharge constituents in the receiving environment at the time of day when the discharge is present. They can also be used to show worst-case scenario situations, e.g. in the case of surface scums of algae or oil and greases. However, taking manual grab samples is labor intensive and often impractical for long, intensive sampling plans.

Composite samples

Composite samples are those collected through mixing multiple grab samples to obtain a single mixed sample. Compositing samples can increase the temporal and spatial extent of sampling, without increasing the number of samples or sampling and analysis costs. These types of samples are used when the average water quality characteristics are of interest over a given period of time or volume of flow. They may be more appropriate than grab samples when the distribution of constituents within the waste stream is random or when the variability within that stream is low. Composite samples are also useful when the determination of loads of constituents is required. However, compositing does have its limitations. Prior knowledge of the stream is required to determine if composite samples are appropriate (i.e. random distribution of contaminants and low variability). This may require a pilot study of discrete grab samples.

Additionally, compositing may mask variability within the waste stream by hiding peak and trough concentrations.

Influent samples at wastewater treatment plants should be collected upstream of any recirculation flows such as supernatant, filtrate, sludge and filter backwash, or any treatment. The following are preferred influent sampling points:

- Downstream of a comminutor, bar screen or other screening device.
- Inlet to the distribution box or channel following a raw wastewater pumping station or force main from a main lift station.
- Inlet to a grit chamber.
- Wet well of a raw wastewater pumping station.
- Sample bottles are to filled allowing a small headspace about 1''unless otherwise advised
- Don't sample from a single point (recommend a minimum of two samples)
- Confirm the free chlorine residual at the time and location of sample collection

Effluent samples at wastewater treatment plants should be collected at the most representative site downstream of all entering waste streams and treatment prior to being discharged to the receiving water body.

Rules for sampling

• Label the bottle before taking a water sample

• Do not touch the inside of the bottle

• Do not rinse the bottle

• Do not put the bottle cap on the ground while sampling

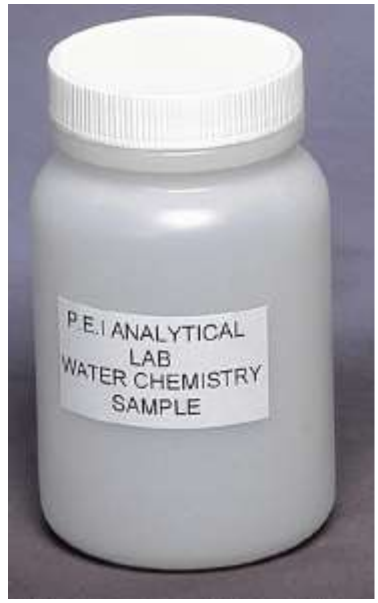

fig 24 1000ml plastic sample bottle

Fig25 300 ml disposable polypropylene sampling bottlel

Fig 26 spot sampling an aeration basin

2.2.3 Water quality test procedures

Rules for sampling

- Wash hands before starting work
- Regularly clean your working area with disinfectant
- Put testing equipment in a clean place
- Never eat, smoke or drink when carrying out water quality tests
- Cover wounds with a waterproof dressing or wear gloves
- Never touch the inside of equipment – sample containers, Petri dishes, measuring containers
- Calibrate equipment according to directions
- Check to ensure reagents have not expired

BOD Test Procedures

1. 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.

2. 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."

3. 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.

4. 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.

5. 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.

The five- days BOD of a diluted sample is given by

BOD5 = (DOi– DOf)

Or if the sample was diluted BOD5 = (DOi– DOf) × D.F

Where D.F = Dilution Factor = (Vol. of wastewater + dilution water)

(Vol. of wastewater)

Fig 27 BOD test

Determination of Chemical Oxygen Demand:

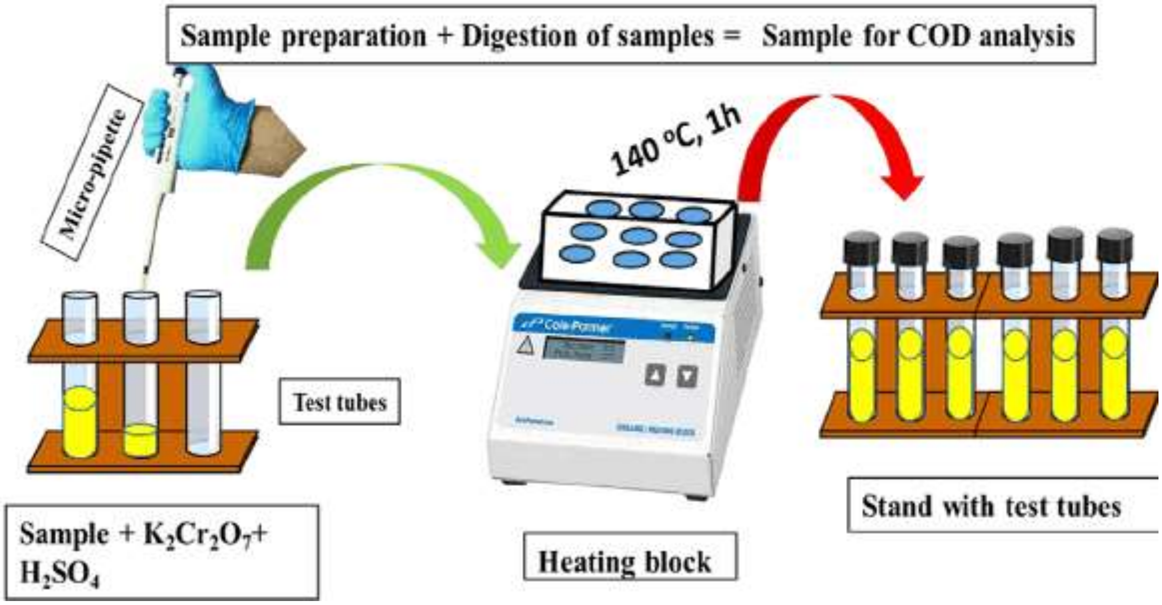

Fig: 28 determination of chemical oxygen demand (COD)

Reagent:

1.Dilute sulfuric acid

2 Standard Ammonium Oxalate

3. Standard potassium permanganate

Testing Procedure:

1. Pipette 100 ml of the sample into a 250 ml Erlenmeyer flask.
2. Add 10 ml. diluted sulfuric acid and 10 ml of standard potassium permanganate.
3. Heat the flask in a boiling water bath for exactly 30 minutes, keeping the water in the bath above the level of the solution in the flask .The heating enhances the rate of oxidation reaction in the Flask.
4. If the solution becomes faintly colored, it means that most of the potassium permanganate has been utilized in the oxidation of organic matter. In such a case, repeat the above using a smaller sample diluted to 100 ml with distilled eater.
5. After 30 minutes in the water bath, add 10 ml of standard ammonium oxalate into the flask. This 10 ml ammonium oxalate , which is a reducing agent , is just

equivalent to the 10 ml potassium permanganate (oxidizing agent) added earlier. The excess of reducing agent (ammonium oxalate) now remaining in the flask is just equivalent to the amount of the oxidizing agent (potassium permanganate) used in the oxidation of organic matter.

6. The quantity of ammonium oxalate remaining in the flask is now determined by titration with standard potassium permanganate. Titrate the content of the flask while hot, with standard potassium permanganate to the first pink coloration. Record the ml of potassium permanganate used.

Calculation:

COD (mg /l) = [ml of MnO_4 used in step (6) × (100)/ ml of sample used]

Information Sheet 3- Implementing emergency procedures

3.1 emergency response procedures

1. Stay Calm

This is a basic element of responding to any challenging situation. Staying calm is always key. There are certain practices and tactics people can take to calm themselves, such as deep breaths, meditation and calming visualization. Having a sound approach and stable mind is key in tackling some of the issues in the workplace that can be quite complex and demand a great deal of your attention.

2. Follow Plans & Protocols

A key to safety awareness is adherence to all relevant regulations. On a local, federal or organizational level, these directives are applied on a daily basis.By making sure your safety program is in a top-notch state, you'll set yourself up to deal with emergencies in the appropriate manner.

3. Follow Up & Resolve

Examining what causes incidents is key in preventing future problems. In addition to examining the root causes, it is imperative to also ascertain how those who were involved in the incident were affected. To truly resolve the matters at hand, one must break down the response strategy and discern what went right and what went wrong.

Effluent treatment plant (ETP) emergency response procedures

Step 1: Identify the potential emergency situations and what could be the severity of each emergency situation according to the potential impacts on the environment, the ETP disruption level, the time estimated to fix the issue, etc.

Potential emergency situations:	Severity level according to potential impacts (minor, significant and major):
• Power supply failure • Flooding / effluent overflow • Fire breakout • Abnormal discharge in an ETP tank • Wastewater spill Etc.	Example: for emergency “Wastewater spill”: • Minor: minor spill, no risk of personnel injury, no contact with the soil and the breach in the pipeline/tank can be fixed within 24 hours; • Significant: significant spill, contact with the soil/groundwater probable, important maintenance required to fix the problem so

	likely to take more than 24 hours; • Major: massive disruption of the ETP causing major leaks, ETP operations must be stopped for several days, maybe weeks to fix the problem.

Step 2: **Write the ETP** emergency response plan. It should cover the chapters as follow:

- ✓ General list of contacts with phone numbers of people to be notified in case of emergency;
- ✓ For each emergency situation:
  - How to report the incident and to notify it to the responsible authorities;
  - Measures taken to prevent or minimize the recurrence of incidents.
  - Actions to be taken to minimize the damage according to the level of severity (minor, significant and major) and who should be notified in this specific situation. See example below:

Emergency situation 1			
Level of severity	What it means ?	Actions to be taken	Who should be notified?
Minor	Ex : minor spill, no risk of personnel injury, no contact with the soil and the breach in the pipeline/tank can be fixed within 24 hours	Ex: contact the technician for the maintenance of the pipeline leaking, request him to identify what could be the origin of the breach, clean-up the spill, etc.	Ex: ETP manager/in charge, Compliance Manager, Utility manager
Significant			
Major			

LG #48	LO4: Hand over waste water treatment operation

Instruction sheet

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

- Maintaining workplace records
- Carrying out handover
- Ensuring operators awareness

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:

- Maintaining workplace records
- Carrying out handover
- Ensuring operators awareness

Learning Instructions:

Read the specific objectives of this Learning Guide.

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

InformationSheet1- Maintaining workplace records

1.1.Maintaining Workplace records

Workplace records are an important part of any work environment and should be accurately maintained within the required timeframes

Types of workplace records

A. Staff records

These are records relating to any and all aspects of staffing the premises. May be divided into overall records and individual staff records

Overall records

- ✓ Staffing rosters
- ✓ Training details by operational area
- ✓ Annual leave planning chart
- ✓ Salary and overtime payments
- ✓ Injury records.

Individual staff records

- ✓ Record of uniform orders
- ✓ Training schedule
- ✓ Direct salary deduction details
- ✓ Injury claims.

Overall records are those records kept that relate to staff as a whole

Types of records

Staff may be given required to complete records such as:

- Time sheets
- Requisitions
- Internal transfers
- Requests for maintenance

- Daily takings sheets.

Importance of records

- For continuous monitoring of quality system
- For specimen tracking throughout process
- To identify failures in equipment
- To revisit information; reference
- For use as a management tool

Workplace information

- Chemical addition instructions
- verbal or written operating procedures
- specifications: detailed description of design criteria for a piece of work
- production schedules

InformationSheet-2- Carrying out handover

2.1 Carrying out handover according to workplace procedure

2.1.1 Handover responsibility procedure

- Handover according to the required legal or regulatory requirements, organizational health, safety, environmental and hygiene standards or instructions
- Take precautions to ensure that production is not interrupted during handover
- Maintain quality standards during task handover
- Provide information in accordance with organizational procedures
- Exchange information in accordance with organizational procedures

Shift handover should be:

1. conducted face-to-face;
2. two-way, with both participants taking joint responsibility;
3. done using both verbal and written communication;
4. based on an analysis of the information needs of incoming staff;
5. Given as much time and resource as necessary.

Be prepared and make the time for a good handover. Remember: right person, right place, and right time. Keep handovers succinct and avoid repetition.

Key Components of a Handover Report

- The Precise Status of Ongoing Tasks. Specifically, this section entails a brief but detailed description of all the unfinished projects and tasks.
- Upcoming Deadlines.
- Forthcoming Events.
- Distinctive Roles

Checklist of what could be included in the project handover plan: Identifying and managing key stakeholders including the group who will receive the handover. A clear date for handover of the part.

A communication plan that starts early in the life of the project and includes the target group

Information sheet 3-Ensuring operators awareness

3.1 Aware   waste water treatment operator's system status

Treatment plant operators have many responsibilities ranging from:

- Planning and Design
- Operations and Maintenance
- Public relations
- Supervision
- Laboratory procedures

Roles of the Treatment Plant Operator

- Duties and Responsibilities of the Treatment Plant Operator
- Planning, Design, and Construction of New Facilities
- Administration
- Wastewater Treatment Plant Operations and Maintenance
- Public Relations
- Safety
- Continuing Education

LG#49	LO#5 shutdown the waste water treatment process

Instruction sheet

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

- Shut down the system
- Prepare system for storage in shutdown mode
- Identify and report Operational maintenance requirements

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:

- Shut down the system
- Prepare system for storage in shutdown mode
- Identify and report Operational maintenance requirements

Learning Instructions:

Read the specific objectives of this Learning Guide.

1. Follow the instructions described below.
2. Read the information written in the "Information Sheets". Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
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8. If your performance is unsatisfactory, see your trainer for further instructions or go back to "Operation sheets".

Information Sheet 1- Shutting down the system and preparing system for storage shutdown mode

1.1 Shut down the process

At process plants, most alteration, inspection, repair, replacement, and minor maintenance work can be done while the plant is in operation. In spite of these activities, however, without scheduled maintenance outages equipment will eventually fail. An unscheduled outage is in most cases substantially more expensive than a scheduled one, and the cost is substantially higher again if the outage is due to a catastrophic failure. Therefore, in order to minimise costs, a plant needs to undergo scheduled process outages for major maintenance work and for possible modifications
of the facility. Such an outage is referred to as a plant shutdown. Most major scheduled plant shutdowns are of high intensity involving sometimes hundreds of people.

Water treatment is the process of removing all those substances, whether biological, chemical or physical, those are potentially harmful in water supply for human and domestic use.

Storage should be in a secure area, away from an excessive heat source, and free from combustible materials that could react in the presence of chlorine. They should be located above ground level, and have adequate ventilation. The area should be protected from direct sunlight since temperature control is essential.

1.2 Preparing system for storage in shutdown mode

Storage Systems - these systems are designed to hold liquid wastes or waste water for treatment, storage, or disposal. They are usually composed of various types of earthen and/or concrete-lined basins, known as surface impoundments. Storage systems are used typically for accumulating waste water before its ultimate disposal, or for temporarily holding batch (intermittent) streams before treatment.

Shut-down procedure involves the systematic stopping of the treatment process. The different modes of shut-down include: normal shut-down of the plant, partial shut-down of the plant, placing the plant on standby and emergency shut-down of the plant. These different modes of shut-down are normally activated by alarms and safety trip systems as well as interlock systems.

1.2.1 For A Shut Down Less Than One Week

- Shut down each unit.
- Shut down all chemical units and rinse all lines (see chemical units).
- Restart normally.

1.2.2 For A Shut Down Between One and Two Weeks

- Shut down each unit.
- Shut down all chemical units and rinse all lines (see chemical units).
- Restart normally
- Empty filters.
- Before shut down, use an excessive amount of chlorine to prevent bacterial growth in the structures (if the chlorination is not available, pour chlorine dosed at the breakpoint + 5 ppm for one hour).
- Restart normally. Wash filters according to first time washing procedures given in Section

1.2.3 For A Shut Down Between Two Weeks And One Month

- Shut down each unit.
- Shut down all chemical units and rinse all lines (see chemical units).
- Restart normally
- Empty filters.
- Before shut down, use an excessive amount of chlorine to prevent bacterial growth in the structures (if the chlorination is not available, pour chlorine dosed at the breakpoint + 5 ppm for one hour).
- Restart normally. Wash filters according to first time washing procedures given in Section
- Empty and clean the tanks of certain chemicals (lime, Calcium hypochlorite, etc.); fill these tanks with service water.
- Restart normally after preparing the chemicals.

1.2.4 For A Shut Down Over One Month

- Shut down each unit.
- Shut down all chemical units and rinse all lines (see chemical units).

- Restart normally
- Empty filters.
- Before shut down, use an excessive amount of chlorine to prevent bacterial growth in the structures (if the chlorination is not available, pour chlorine dosed at the breakpoint + 5 ppm for one hour).
- Restart normally. Wash filters according to first time washing procedures given in Section
- Empty and clean the tanks of certain chemicals (lime, Calcium hypochlorite, etc.); fill these tanks with service water.
- Restart normally after preparing the chemicals.
- Empty all chemical tanks, clean them and fill them with service water.
- Clean all plant components.
- Empty and clean all the structures.
- Restart as for initial start-up.

Information Sheet 2 - Identify and report Operational maintenance requirements

2.1 Identifying and reporting maintenance requirements

Maintenance helps to protect the capital investment and ensures an effective and economical expenditure in operating and maintaining the sewerage facilities.

Preventive maintenance is more economical and provides for reliability in operations of the sewer facilities.

To operate and maintain a sewer collection system to function as intended, the maintenance engineer should try to strive towards the following objectives:

- Minimize the number of blockages per unit length of sewer, and
- Minimize the number of odor complaints.

Maintenance of production equipment in industrial enterprises plays an increasingly important role. It is quite obvious that it can eliminate a number of risks associated with the business and ensure effective use of financial resources necessary to ensure the working order of the machinery and equipment of the businesses.

Properly performed maintenance can contribute to gaining a competitive advantage.

This is essential for increasing the profit of the beverage industry

The main routine maintenance activities are:-

- Removal of screenings and grit from the preliminary treatment units
- Periodically cutting the grass on the pond embankments
- Removal of scum and floating macrophytes from the surface of facultative ponds and maturation ponds. This is done to maximize the light energy reaching the pond algae, increase surface re-aeration, and prevent fly and mosquito breeding
- If flies are breeding in large numbers on the scum on anaerobic plant, the scum should be broken up and sunk with a water jet
- Removal of any material blocking the plant inlets and outlet

LG#50	LO #5- Record information

Instruction sheet

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

- Record Workplace information
- Sign records
- Communicate information.
- Keep workplace information records

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:

- Record Workplace information
- Sign records
- Communicate information.
- Keep workplace information records

Learning Instructions:

Read the specific objectives of this Learning Guide.

1. Follow the instructions described below.
2. Read the information written in the "Information Sheets". Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
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Information Sheet1- Recording workplace information

1.1Standard Operating Procedures (SOPs)

An important aspect of a quality system is to work according to unambiguous Standard Operating Procedures (SOPs). In fact the whole process from sampling to the filing of the analytical result should be described by a continuous series of SOPs. A SOP for a laboratory can be defined as follows:

"A Standard Operating Procedure is a document which describes the regularly recurring operations relevant to the quality of the investigation. The purpose of a SOP is to carry out the operations correctly and always in the same manner. A SOP should be available at the place where the work is done".

A SOP is a compulsory instruction. If deviations from this instruction are allowed, the conditions for these should be documented including who can give permission for this and what exactly the complete procedure will be. The original should rest at a secure place while working copies should be authenticated with stamps and/or signatures of authorized person.

1.2 Material safety data sheet

A Material Safety Data Sheet (MSDS) is a document that contains information on the potential hazards (health, fire, reactivity and environmental) and how to work safely with the chemical product. It is an essential starting point for the development of a complete health and safety program. It also contains information on the use, storage, handling and emergency procedures all related to the hazards of the material. The MSDS contains much more information about the material than the label. MSDSs are prepared by the supplier or manufacturer of the material. It is intended to tell what the hazards of the product are, how to use the product safely, what to expect if the recommendations are not followed, what to do if accidents occur, how to recognize symptoms of overexposure, and what to do if such incidents occur.

MSDS information

These categories are specified in the Controlled Products Regulations and include:

- Product Information: product identifier (name), manufacturer and suppliers names, addresses, and emergency phone numbers
- Hazardous Ingredients
- Physical Data
- Fire or Explosion Hazard Data
- Reactivity Data: information on the chemical instability of a product and the substances it may react with
- Toxicological Properties: health effects
- Preventive Measures
- First Aid Measures
- Preparation Information: who is responsible for preparation and date of preparation of MSDS

The Controlled Products Regulations prescribes what information must be present in more detail.

Work note: an example of work note is shown by the following table

Table 1

Instrument calibration log

Project Name_______________ Date________________ Weather__________

Calibrated by_______________ Instrument___________

Serial Number_________

Parameters	Morning Calibration	Morning Temperature	End of Day Calibration Check*	End of Day Temperature
pH (7)				
pH (4))				
pH (10				
Dissolved Oxygen 100% water saturated air mg/L				
Dissolved Oxygen Zero Dissolved Oxygen Solution mg/L				
Turbidity Standard#1				
Turbidity Standard#2				
Turbidity Standard#3				

Information Sheet 2 Signing records

Signatures are basically our IDs, which tells others that it's us and not anybody else they are the only authenticity of a person's being. In operating malt grain preparation information records the operator who was conducting the operation process should sigh on the workplace information record in order to identify the identity of the operator.so co-workers can easily authenticate the records.

All of the following records should be signed

- Raw water samples
- Quality analysis test
- Treatment shift
- Batch requirements
- Work notes
- Maintenance requirements
- Safety requirements

The following table will show you how to collect sample and were to record

Logo of the industry

Name of the industry

[Name of responsible body……………………..]

Sampling and bacteriological, chemical analysis

Sample data:

Sample size:___________________________________

Date collected:__________________________________

Time collected:__________________________________

Time of analysis:______________________________

Residual chlorine: ______________________________mg/l

Results:

PH____

BOD____

COD____

Laboratory sample number

Water quality

Good-bad

Action taken

____

____

____

____

[signed]

Information sheet 3 communicating information

If work is being taken over by the next shift or another crew, a handover should occur. This involves discussing the stages, testing sample have been taken (e.g. turbidity, PH, BOD,COD, color, odor etc.) the treatment is at and changing over locks and personal danger tags.

The only worker who should remove personal danger locks and tags is the person who put them in place. A procedure should be available which first considers all options to allow the person who placed the lock and tag to personally remove them, consider emergencies and/or if the worker is unable to remove the lock. If the worker cannot remove the lock and tag, the employer should ensure:

- a senior person is accountable for the lock and tag
- the situation is assessed to be safe before removing the lock and tag
- Ensure the removal is validated and signed off by two or more people.

To do any activity ,technician should communicated with concerned body via necessary communication channels ,which may be up ward and down ward or horizontally these may leads to avoid unnecessary production down time and other related messes. And after all you have to get a confirmation to go ahead maintenance activity, unless never do maintenance activity by yourself.

Workplace Information records can be kept in different method but malt industries use Paper passed storage and Electronic storage method.

4.1 Paper - Based Storage

Record storage & equipment depends on the space available, the security required, the frequency of access needed, the nature of the records to be stored, the number of people accessing the records and protection from climatic variations.

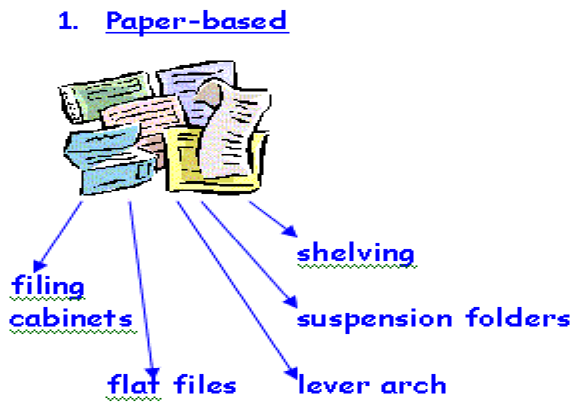

Fig28 paper based record storage

beverage industries prefer to store paper based record in filing cabinets.

Fig 29 cabinets record storage

4.2 Electronic Storage

Nowadays many records are kept electronically. They are convenient and don't use up too much space.

Electronic records include:

- Computer databases
- Electronic correspondence eg- email
- Computer files of letters, memos and other documents.

The files are usually stored in the hard drive of the computer and copied for back-up and transportation.

Confidentiality and Security

It is important to take satisfactory measures to ensure information in files is kept confidential. It is therefore important that files are:

- not to be left unattended
- locked securely when not in use
- accessed by authorized staff only
- accessed either via the authorized person (paper based) or a username / password (electronic based)

Access might be coded in various levels. For example:

Green may be for Open Access where files are freely available for operators

Purple may be for Restricted Access where records can be borrowed only with authorization.

Red files are High Security and only accessible to authorized personnel

Reference Materials

1 Marshall, R. *Best Management Practices Guide for Nutrient Management in Effluent Treatment*, TechnicalReport for Forest Products Association of Canada: Ottawa, ON, Canada, April, 2008.

2 U.S. EPA Method 351.2: Determination of Total Kjeldahl Nitrogen by Semi-Automated Colorimetry.Cincinnati, Ohio, August 1993.

3. INTRODUCTION TO DRINKING WATER QUALITY TESTING A CAWST TRAINING MANUALJune 2009 Edition

4. APHA. 2005. Standard methods for the Examination of Water and Wastewater. 21st Edition. American Public Health Association, Washington, D.C.

5. CSUS. 1993. Operation of Wastewater Treatment Plants. Volume 2. 4th Edition. California State University, Sacramento, CA.

6. Metcalf & Eddy, Inc. 2003. Wastewater Engineering: Treatment and Reuse. 4th Edition. McGraw-Hill, New York, NY.

7. WHO (2004). *Guidelines for drinking-water quality*, 3rd ed., World Health Organization,Geneva.

8. Wastewater Treatment Processes by Dr. Arun Kumar (arunku@civil.iitd.ac.in) Wastewater

WEB ADDRESSES

1. Website: www.cawst.org
2. www.waterwatch.nsw.gov.au
3. www.namoi.cma.nsw.gov.au

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The trainers who developed the learning guide

No	Name	Qualification	Educational background	Region	E-mail
1.	Mewleddeg girma	B	Food science and post-harvest technology	Sidama	mewegirma@gmail.com
2.	Biruktayt muluneh	B	Chemical engenering (process)	SNNPR	Edenwondimu12@gmail.com/
3.	Alemayehu araya	B	Food science and post-harvest technology	Addis Ababa	alemayohmr@gmail.com
4.	Mamo Abdi	B	BSC in agriculture	Oromiya TVET Bureau dev't Facilitator	Mamoab57@gmail.com
5.	Workneh Asmamaw	B	BSC in agri.economy	FTA dev't Facilitator	workalemaw@gmail.com