TECHNICAL REPORT

ON STUDENT INDUSTRIAL WORK EXPERIENCE SCHEME *(SIWES)*

HELD AT

SKAMKAB NIG. LTD, NO 10, OKE FOMA BABALAJE MEDINA AREA, ILORIN KWARA STATE

PRESENTED BY

MUHAMMED KABIR

ND/23/BAM/PT/0542

A SIWES REPORT SUBMITTED TO THE INSTITUTE OF FINANCE

AND MANAGEMENT STUDIES (IFMS)

IN PARTIAL FUFILMENT OF THE REQUIREMENT FOR THE

AWARD OF NATIONAL DIPLOMA [ND] IN THE DEPARTMENT OF

BUSINESS ADMINISTRATION

CERTIFICATION

This is to certify that **MUHAMMED KABIR** with matriculation number **ND/23/BAM/PT/0542** undergoes his industrial training **SIWES** at **Skamkab Nig. Ltd, No 10, Oke Foma Babalajemedina Area, Ilorin Kwara State**. In partial fulfillment of the award of national diploma (**ND**) in Business Administration, **Kwara State Polytechnic, Ilorin** undersigned by the following people:

SIWES SUPERVISOR **DATE**
MR. POPOOLA ____________________
____

HEAD OF DEPARTMENT **DATE**
MR. ADAM NDAGI _____________________
____

DEDICATION

This SIWES report is dedicated to GOD Almighty, and my lovely parents Mr. & Mrs. **Muhammed**. For their spiritual and financial support during my SIWES program.

ACKNOWLEDGEMENT

My appreciation first goes to ALLAH almighty, the creator of Heaven and Earth for granting me the grace and privilege to be able to complete this SIWES program successfully and on schedule.

I am also grateful to my industrial based supervisors Mr. Popoola and my tutors for their thorough supervision and useful advice which helped and also contributed to the success of the SIWES program. May the almighty Allah make their days on Earth longer to reap the fruit of their labor to the fullest AMEN

Also I cannot but acknowledge my germane H.O.D, Mr. Adam Ndagi and all the lecturers in the department of Business Administration.

Thanks and Allah bless you all.

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF SIWES

The SIWES is a skill training program and forms part of the approval of minimum academic standard in various degree programs in the various Universities. It is an effort to bridge the gap between theory and practical. According to Ochiagha (1995) practical is learning without which mastery of an area of knowledge might be difficult to achieve. The SIWES is a planned and supervised training intervention based on stated and specific learning of career objectives and geared towards developing occupational competence of the participants. It is a program required to be undertaken by students of tertiary institutions in Nigeria pursuing science and educational courses. The work experience program gives students the opportunity to be part of the actual work situation outside the classroom. Usually SIWES last for four months in Polytechnics at the end of ND 1, four months in colleges of education at the end of NCE 2 and six months in the Universities at the end of 300 or 400 levels depending on the discipline.

1.2 AIM AND OBJECTIVES OF SIWES

SIWES provides avenue for students to acquire industrial skills and experience in their approved course of study and also prepares students for their industrial work situation after graduation.

The objectives of the students' industrial training work experience scheme are:

- To provide an avenue for students in the Nigerian tertiary institutions to acquire the basic industrial skills and experiences that are relevant to their course of study.
- To prepare students for the work situation they are likely to encounter after graduation.
- To make transition from the university to the world of work easier hence enhancing students contact for subsequent job placement after graduation.

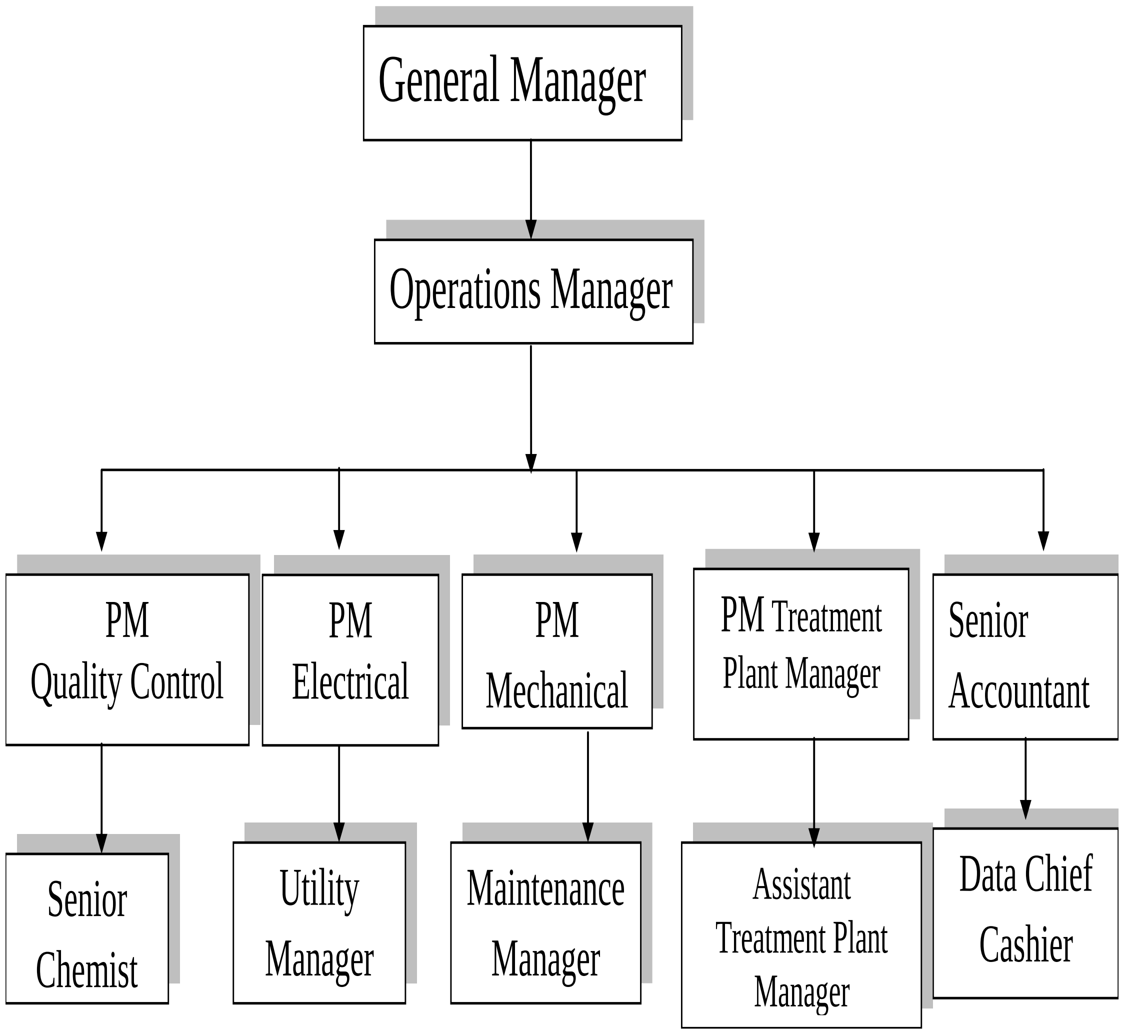
- To expose students to work techniques and methods of handling equipments and machinery that may not be readily available in their institution of learning.
- Provide students with an opportunity to apply their theoretical knowledge in real work situation, thereby bridging the gap between theory and actual practice.
- To enlist and strengthen employers involvement in the entire educational process of preparing university graduates for employment.

1.3 BRIEF HISTORY OF SKAMKAB

Skamkab table Water was established in the year 2000 to cater for the demand of quality or safe drinking water in the Oke Foma Ilorin Kwara State. The water was formerly called Skamkab table Water organization Corporation. It has one office in each of the state in Lagos along Ikorodu Road. At inception, it started with 100 workers and now increased to 120. There were 21 boreholes as water source until in 2005 when the Board finally constructed Water Treatment Plant at Oke Foma Babalaje Ilorin Kwara State which is still maintained by Skamkab Company) Nig. Ltd.

Quality control unit is one of the units in the all-state that was established in order to ensure the quality of water produced and supplied by the Board is safe enough to meet the standard requirement by World and National Health Agencies. The unit also analyses water samples brought by commercial table water producers, residence overhead tanks for confirmation and for students' researches.

1.4 ORGANIZATIONAL CHART



PM= Principal Manager

CHAPTER TWO

WORKING EXPERIENCE

Knowledge Acquired During the Attachment

2.1 WATER QUALITY TEST

Water quality is a measure of the condition of water relative to the requirements of one or more biotic species and or to any human need and purpose.

Water quality test at Skamkab State Water organization is carried out at the Quality control unit which is one of the units at the Board. It was established in order to ensure the quality of water produced and supplied by the organization is safe enough to meet the standard requirement by World and National Health Agencies. The unit also analyses water samples brought by commercial table water producers, residence overhead tanks for confirmation and for students' researches. The water quality tests that are usually carried out at the quality control unit.

2.1.3 Bacteriological Analysis

Bacteriological water analysis is a method of analyzing water to estimate the numbers of bacteria present and if needed to find out what sort of bacteria they are. It represents one aspect of water quality. It is a microbiological analytical procedure which uses samples of water and from these samples determines the concentration of bacteria.

Aims of the analysis include:

- To enumerate the number of bacteria present in drinking water.
- To identify the bacteria present in drinking water sample.

Methodology

The methods used in the laboratory of the quality control unit of Kwara State Water Board include:

- Most Probable Number (MPN) index method

- Membrane Filter Method
- Pour Plate method

The MPN Index Method

Most Probable Number (MPN) method is a statistical method based on the random dispersion of microorganisms per volume in a given sample. In this method, measured volumes of water are added to a series of Bijou bottles containing a liquid indicator growth medium. The media receiving one or more indicator bacteria show growth and a characteristic color change. Color change is absent in those receiving an inoculums of water without indicator bacteria. From the number and distribution of positive and negative reactions, the MPN of indicator organis*ms in the sample may be estimated by reference to statistical tables.

MPN test is completed in three steps:

- Presumptive test
- Confirmed test
- Completed test

Requirements

- Water sample
- Distilled water
- Weighing balance
- Pipette (25 and 10ml)
- Glass rod (stirrer)
- Durham's tubes
- Test tubes
- Beaker
- Media

- Wire loop
- Masking tape
- Petri dishes
- Autoclave/oven
- Incubator
- Spatula

The Presumptive Test

This is used for the detection and estimation of coliform in water sample. For estimation of coliforms, lactose broth medium is used. Outlined below are the basic steps in this test.

- Prepare lactose broth media of double strength if the water is treated or single if the water is not treated. Pipette 10ml into each small bijou bottle with Durham's tube. And 50ml into the big bottles with test tube and autoclave it.
- After autoclaving, allow to cool to room temperature. Using sterile pipettes transfer 10ml of the water sample to each of the small bottles and 50ml to each of the big bottles.
- Incubate the bottles at 37°C for 24hrs.
- After incubation, observe the gas production in Durham's tube and test tube and colour change of the media.
- Record the number of positive results from set of bottles and compare with standard chart to give presumptive coliform count per 100ml water sample.

The Confirmed Test

Some spore forming bacteria give false positive test in presumptive test. Confirmed test is done to determine that the coliforms are of fecal origin or not. And they are E. coli or not. Below are the basic steps in this test.

- Take the positive bottle from the presumptive test and using EMB in duplicate.

- Incubate one plate at 37°C for 24 hours and another at 44.5°C for 24 hours.
- Look for typical colonies in the media; blue black with green metallic colonies are of E. coli in EMB agar.

The Completed Test

- Inoculate the colony in a bottle of lactose broth with Durham's tube/test tube.
- Incubate the broth cultures at 37°C.
- xamine for acid and gas production in lactose broth.

Note: Observe aseptic technique throughout the procedure.

Result

From the number and distribution of positive and negative reactions, the MPN of indicator organisms in the sample may be estimated by reference to statistical tables. For the presumptive and the completed tests, production of gas in the Durham's tubes, odor and turbidity indicate bacterial growth which is considered as positive test for coliforms in water sample.

Below is the statistical table used in the laboratory for estimating the MPN of indicator organisms in water sample.

Table 2.1: MPN index and 95 per cent confidence limits for various combinations of positive

Results for a set of one 50 ml and five 10 ml portions of sample

Number of tubes giving positive reaction		MPN Index per 100 ml	95 % confidence limits	
1 X 50 ml	5 x 10 ml		LOWER	UPPER
0	0	<1		
0	1	1	0.5	4
0	2	2	0.5	6
0	3	4	0.5	11
0	4	5	1	13

0	5	7	2	17
1	0	2	0.5	6
1	1	3	0.5	9
1	2	6	1	15
1	3	9	2	21
1	4	16	4	40
1	5	>18		

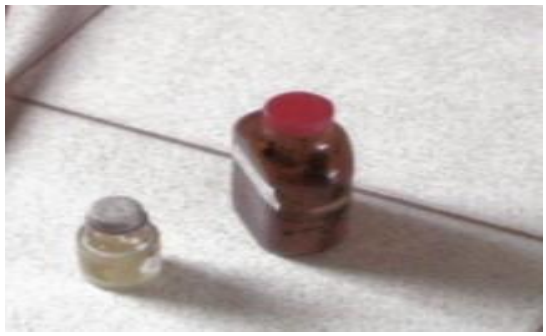


Fig.2.1: Contaminated water sample

Fig.2.2: Petri dish containing colonies of *E. coli*

Presence of typical colonies at 37^{o}c confirms positive coliform test and those at 44.5^{o}cconfirms the presence of *E. coli.*

Table 2.2: WHO bacteriological quality of drinking water (WHO,1996)

Microorganisms	Guideline values
All water intended for drinking	
E. coli or thermotolerant coliform bacteria	Must not be detectable in any 100ml sample
Total coliform bacteria	Must not be detectable in any 100ml sample

2.2 WATER TREATMENT

During my SIWES program at GSWB, myself and other students from various institutions were from time to time taken to the Skamkab water treatment plant to see to ourselves and observe all that is going on at the plant. I must confess that during those periods of visitation to the treatment plant I have learned a lot about water treatment, the chemicals used, the equipment utilized and the processes involved. So at this point I would like to discuss what I saw and learned at the treatment plant.

2.2.1 Meaning of Water Treatment

Water treatment is any process that makes water more acceptable for a specific end-use. The end use may be drinking, industrial water supply, irrigation, river flow maintenance, water recreation or many other uses, including being safely returned to the environment. Water treatment removes contaminants and undesirable components, or reduces their concentration so that the water becomes fit for its desired end-use. Treatment for drinking water production involves the removal of contaminants from raw water to produce water that is pure enough for human consumption without any short term or long term risk of any adverse health effect. Substances that are removed during the process of drinking water treatment include suspended solids, bacteria, algae, viruses, fungi, and minerals such as iron and manganese.

2.2.2 Skamkab Water Treatment Plant

To start with, water treatment plant is collectively, the industrial-scale processes that make water more acceptable for an end-use, which may be drinking, industrial water supply, irrigation, river flow maintenance, water recreation or many other uses, including being safely returned to the environment.

As it is stated earlier, Skamkab water treatment plant was commissioned in the year 2006. It is located in the town of Skamkab, Kwara Nigeria. Skamkab water plant has the capacity of fifty thousand tons, covering an area of about 150mus (around 100,000sqm).

2.2.3 The Need for Water Treatment

The two main reasons for treating water are 1) to remove those contaminants that are harmful to health and 2) to remove contaminants that make the water look, taste, taste, or smell bad. Since many contaminants harmful to health cannot be seen, smelled, or tasted, early water treatment efforts focused on making the water more appealing to the consumer or improving the aesthetic qualities of the water. However, with advance with advances in modern science, our ability to detect microorganisms and very low levels of harmful chemicals has led to advanced treatment technologies to remove health-related contaminants that may be present in very small amount.

2.2.4 Chemicals used at Skamkab Water Treatment Plant

The chemical plant is a building where chemicals are being prepared for the treatment of water, the chemicals used in Skamkab treatment plant are Alum {$Al_2(SO_4)_3$}, polyelectrolyte (PE), chlorine gas (Cl_2), lime {$Ca(OH)_2$}, and calcium hypochlorite (Cl_2O_2Ca). Below are the descriptions of each chemical.

- **Alum**

Aluminium sulphate ($Al_2(SO_4)_3 . 16H_2O$) is commonly used as a coagulant.

Fig.2.3: Aluminium Sulphate

- **+Lime Plant**

Lime ($Ca(OH)_2$) can also be used as a coagulant, but it's mostly used as a pH corrector.

The hydrated lime ($Ca(OH)_2$) is used to standardize the pH value of water before and after treatment.

- **Polyelectrolyte**

  Polyelectrolyte ($Ca(CO_2)_2$) are mostly used to assist flocculation process and are often called flocculation aids, they can be cationic (positively charged), anionic (negatively charged) or non-ionic (no net charges).

- **Calcium hypochlorite Plant**

Calcium hypochlorite (Cl_2O_2Ca), this is the chemical used for disinfections in case of failure in chlorine gas plan. It is usually applied at the post chlorination stage during water treatment.

Fig.1.5 ***Calcium Hypochlorite Plant***

- **Chlorine Plant**

This chemical is used for disinfections and complete elimination of bacteria present in water.

2.2.5 Unit Process Flow at the Skamkab Treatment Plant

A pipe line of diameter DN 1,000 x DN 800, conveys raw water under the influence of gravity from the dam 2km away from the treatment plant. The flow rate is regulated through an inlet valve known as electrical modulating valve into a cascade aerators with perforated trays packed with poly propylene materials, the pre-heated water flows through an open channel known as RCC (Reinforce Concrete Channel) where pre-liming, pre-chlorination and addition of alum takes place. The raw water flows in turbulence flow into the flow splitter box, where partial mixing takes place, it further splitted into three part in which each part goes to the clariflocculator (3 clariflocculator), where polyelectrolyte is being added through the wire to neutralize the charges and form a giant flocs, after forming the giant flocs, the flocs settled very fast so that we can achieve higher clarification. The denser water is at the bottom and the clarified water is at the top, the different in density in the clariflocculator is caused by reverse osmosis. The water flows into the gravity filters in an open channel for filtration and the spent sludge passes to disposal. The filtered water passes through the contact chamber for post chlorination and it is finally conveyed for storage into the clear well for distribution and consumption.

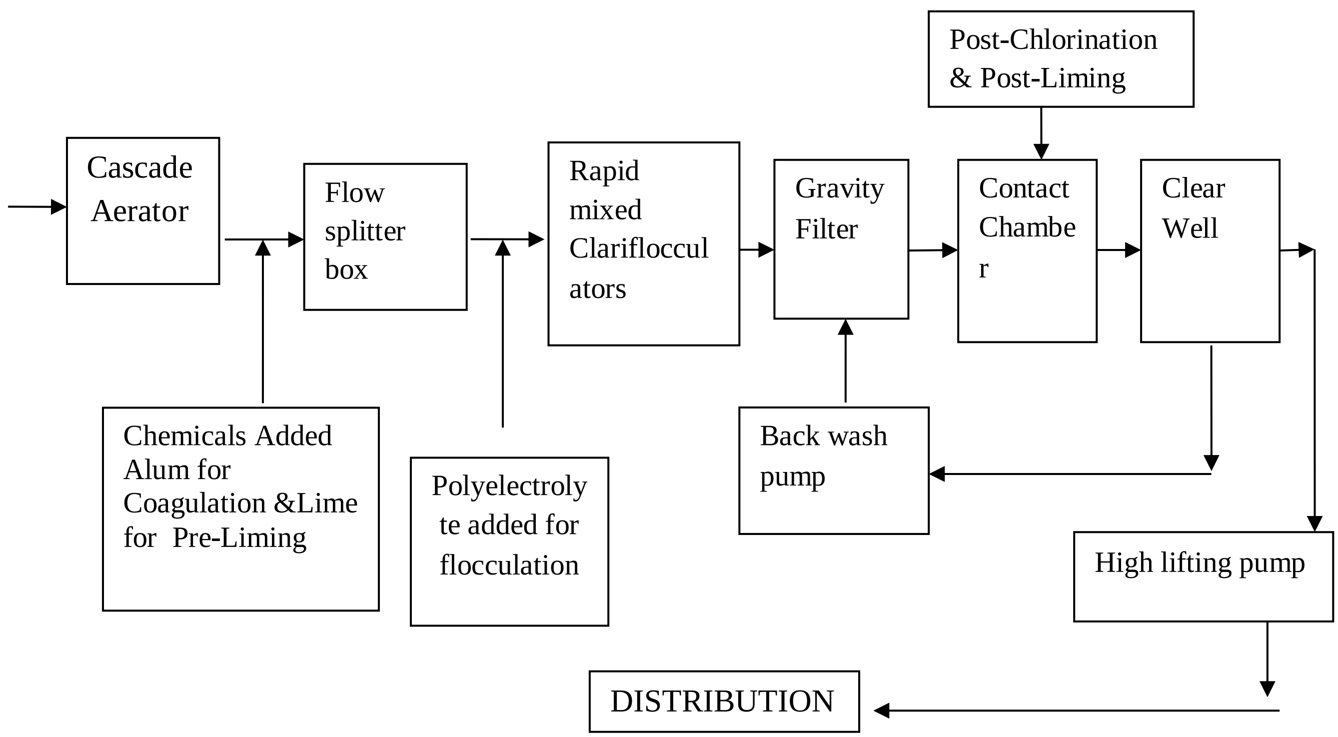


Figure 2.5: Unit process and flow at Kwara State Water Treatment Plant, Skamkab.

2.2.6 Processes Involved in Treating Water at the Skamkab Treatment Plant

The source of water for the Kwara State Water Treatment Plant Skamkab is surface water, the treatment process used is based on the source of water they use and type of contamination or minerals dissolved in it.

Therefore, the sequential order of the treatment process from the raw water stage to its final level of consumption is highlighted and explained bellow.

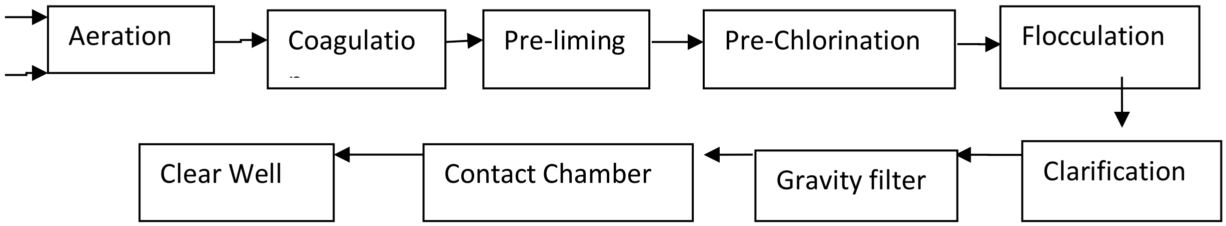


Figure 2.5: Treatment Processes at the Kwara State Water Treatment Plant

- **Aeration**

The Starting point of the treatment process in the Kwara State Water Treatment Plant Skamkab is the Aeration process using the cascade aerators, the raw water from the dam flows directly to cascade aerators where aeration process takes place.

Aeration is a process through which water is being exposed to the air and sunlight (ultraviolent ray). Some of the importance of aeration includes:

1. Reduce the microbial load in the untreated water by destroying the protein coat of some microbes and kill some microbes present.
2. Aeration helps to reduce drastically the ion contents in raw water from the barest level of consumption by exposure to air that is $Fe^{2+}$when exposed to the air becomes Fe^{3+}which is insoluble
3. Removal of volatile substances which may include oxygen, carbon dioxide, nitrogen, hydrogen sulphide, methane, and various unidentified organic compounds responsible for taste and odour.
4. Suspended particles are removed through a perforated trays of different sizes

Figure 2.6: The cascade aerators

- **Coagulation**

The word coagulation according to water treatment practitioners and chemists is referred to as entire process that included addition of chemical coagulants,(iron or aluminum salts), such as aluminum sulphate, iron sulphate, iron chloride or polymers to the water. These chemicals are called coagulants, and have a positive charge. The positive charge of the coagulants neutralizes the negative charge of dissolved and suspended particles in the water.

- **Pre- liming**

Addition of alum to coagulate the water tends to make the water acidic so lime is added to regulate the pH so that the water would be in the range that the chemicals added will work.

- **Flocculation**

The term flocculation refers to water treatment processes that assemble or combine small particles to form a large one (Floc particles) which settle out of the water as sediment upon addition of Flocculants, poly electrolyte (PE) is used as the flocculants and the flocculation process takes place at the Flocculation chamber of the Clarifloculator where the water is agitated and mixed uniformly by the means of mechanical mixer to allow the flocs to be formed. The particles are made to sediment forming what is known as sludge. The sludge then goes downward into the sludge box for dislodging. In clariflocculator, there is a scrapper with an installed power capacity of 1.5 kw which scrapes the compacted sludge into the sludge box. After which sludge diaphragm valve at the external sludge pit is opened to discard the sludge.

Clarification

Once the flocculation process is complete, the water then passes over the weir in the flocculator and travels to the center of the clarifier or sedimentation basin. Here, the water makes its way from the center of the clarifier to the saw tooth weir at the perimeter of the unit. As the water makes its way towards the weir, the large floc particles are allowed to settle out to the bottom of the clarifier.

A rake continuously travels across the bottom of the clarifier and scrapes the settled floc to the center of the unit. The water that passes over the weir is collected and transferred to the filters. The reason clarification occurs before filtration is so the majority of suspended material can be removed prior to filtration. Clarification takes place at the Clarification Basin of the Clariflocculator.

Fig.2.13: The Clariflocculator

- **Filtration**

Clarified water enters the filters from the top. Gravity pulls the water down through the filters where it is collected in a drain system at the bottom of the unit. Filtration which removes suspended and colloidal material that has not been settled. Filtration is a process of sieving the water to remove all the solids suspended particles (unsettled sludge) found in water and is normally performed in a compartment or chamber known as the Gravity filter.

The gravity sand filter is the type of filter used in Skamkab water treatment plant. The water flows into the gravity filter from the clarifier through the inlet gate by gravity and falls through the concrete floor of each filter compartments, where the outlet gate is located. This is done to avoid the incoming water from destabilizing the filter medium, as soon as the water from the inlet gate fills up to the level of the filter media, the filtration process now takes place where the water moves the three different sand layers. After flowing through the filter bed, the filtered water passes through the nozzles into the under drained system where it flows into a collecting channel out of the filter, as the water passes through the bed by gravity, impurities are being trapped. The water is then sent to the contact chamber.

Figure 27: **Gravity filter**

Maintenance of Gravity Filter

The following are the ways by which a filter bed can be maintained:-

1. By making sure that all the filter beds are clean to ensure proper circulation of water.
2. To ensure that there are some air vents attached to the filter water channels through which the filtered water sucks in air, it is expected that the vents should be properly screened as to avoid birds and rodents from entering.
3. Ensure that the water that comes from the clarifier into the filter tanks are less turbid so as to avoid leakage of water and its wastages.
4. Make sure that the outlet gates of the filter tanks are properly closed and sealed to avoid wastage of water.
5. It is important to check if there are cracks in the filter tanks due to vibration and repair so as to avoid impurities from escaping into the filtered water.

- **Backwash Process**

It is very obvious that during filtration process, the porous nature of soil is blocked as a result of spirogyra growth and other impurities. Therefore, for efficient filtration to take place, backwash process must be employed.

The process involved an air blower pump, which blows in air from the filter gallery into the filter bed thereby shaking the sand bed and it will wash itself in the remaining water for about eight minutes

(8mins). The backwash pump will then release treated water into the filter bed. About 0.6m height of water is left inside the gravity bed and air blows inside the gravity filter, as a results, bubbles were observed and the layers formed by spirogyra were destroyed and wash through an outlet pipe to be discarded. The filter will then be cleaned and ready thereby recovering its porosity.

Figure 2.8: The Backwash Pump

- **Post-liming**

After the filtration it may be observed that the pH of the treated water has been altered due to addition of chemicals therefore lime is also added at the end of the treatment process for pH adjustment take place before it is taken to the reservoir (clear well) for storage. This takes place at the contact chamber.

- **Post-chlorination**

Once the water has gone through the filtration process, it is about as clear and clean as it can get. However, there may still be bacteria and viruses remaining. To ensure these are destroyed, there must be a disinfection process employed. The disinfection process used in the United States is chlorination. Chlorine comes in many different forms including chlorine gas (most common), chlorine dioxide, hypochlorite (bleach), and others. Whichever method is used, chlorine is added to the water in an amount to ensure all microorganisms are destroyed. Water plants monitor the chlorine levels continuously and very carefully in the treated water. They must add enough chlorine to ensure thorough disinfection of the water, but avoid adding excesses that can cause taste and odor problems when delivered to the consumer. When chlorine or calcium hypochlorite is introduced for post chlorination The residual (excess) chlorine in the water should be 0.5 mg/l from the treatment plant and 0.25 mg/l to the consumer so that it will take care of the microbes present in the pipes during distribution, when the residual chlorine is above that, it will cause cancer to the consumer.

Figure 2.9: The contact Chamber

The clear Well

Once the disinfection process is complete, the water is stored. Storage usually takes place in an underground storage tank called a “clear well”, and also in elevated storage tanks that are visible around town.

The Lift Pump Station

This is the chamber where stored water is lifted up using high lifting pump machine to convey water into the reservoir. In Skamkab treatment plant a 6400m^3capacity reservoir is located at Tabra hill in Kwara state capital. To enable efficient transfer of water, a water hammer surge vessel with a rated pressure of 40 bar and total volume of 2500L is used to enable water transfer incase of power failure that could damage machine and pipes. The power house has the programming logic controller panel, used for controlling systems and soft starters for the pumps.

Also in conjunction with water transfer, pipelines were affiliated with valve e.g. water valve, air valve and pressure relief etc.

Fig.1.9: The High Lift Pump

Problems Faced During the Attachment

Although my six months Industrial Training was a success, but I cannot deny the fact that I have faced challenges in the course of the training. These challenges include.

1. Electricity Problem

At the quality control unit, Kwara State Water Board, problem of electricity was a major challenge that I experienced. You see, a very large portion of the work I did and is being done in the laboratory requires electric light. Usually work starts by 8am at the board but, sometimes you would find out that we start work by 12pm. In fact, sometimes until 2pm. We would just seat and wait for light to be restored. Because there was no alternative-the board does not have functioning generator. As a result I sometimes stayed in the laboratory up to 6pm conducting analysis. And that was not ideal because working hours end at 4pm. Another thing concerning the issue of electricity is the fact that sometimes in the midst of analysis light will be interrupted and that used to affect our work badly.

2. Lack of Safety wears

Lack of safety wears was another challenge that I faced during the training program. Since I started the training I had never used hand gloves. My hands were always bare when carrying out analyses. And we usually used chemicals that are harmful, besides the analyses were mostly bacteriological so you can imagine the number of bacteria I picked on my hands during each analysis!

3. Financial constrain

From the organization where I undertook my Students Industrial Work Experience Scheme to my residential place is a long distance. So I really spent so much just to transport myself to and from my place of attachment. You see, there was even a day that I almost missed going to work because of transport fare issue. In fact, I cannot hide this, there were some days that I trekked that long distance and sincerely speaking all the days that I did that I felt it in my body. So you see it was actually not funny.

Possible Suggestions to the Problems

- I suggest that the government of Kwara state should consider Kwara State Water Board for rehabilitation. Because, I think by doing so most of the problems the board is facing would be tackled.
- I also suggest to Industrial Training Fund (ITF) that they should review the policy of paying allowance to students on Industrial Training. The policy should be in such a way that the student will be given small amount every month when he or she is still on the training program.

CHAPTER THREE

3.1 CONCLUSION

Industrial training at Samkab water was a huge success and a great time of acquisition of knowledge and skills. Through my training I was able to appreciate my chosen course of study even more, because I had the opportunity to blend the theoretical knowledge acquired from school with the practical hands-on application of knowledge gained here to perform very important tasks that contributed in a way to my productivity in the water Corporation. My training here has given me a broader view to the importance and relevance of biologists in the immediate society and the world as a whole, as I now look forward to impacting it positively after graduation. I have also been able improve my communication and presentation skills and there by developed good relationship with my fellow colleagues at work. I have also been able to appreciate the connection between my course of study and other disciplines in producing a successful result.

3.3 Recommendation

Different organization should be highlighted more about the scheme to ease the training of students.

The continuity of the student industrial work experience scheme (SIWES) as it has helped to bridge the gap between theory and practical knowledge of students.

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