Ranhill SAJ

UNIVERSITI TEKNOLOGI MARA
KAMPUS PASIR GUDANG

INDUSTRIAL TRAINING

REPORT

(CHE 353)

Name: Wan Norazifah Wan Hamzah

Programme: Chemical Engineering

Matrics Number: 2018653176

Internship Duration: 21 March 2021 – 15 July 2021 (17 weeks)

Supervisor: Kamal Bin Kusmi

Company Name: Sultan Iskandar Water Treatment Plant Ranhill SAJ Sdn. Bhd.

Company Address: LRA Sultan Iskandar, Ranhill SAJ Sdn Bhd, Kampung Cahaya Baru, 81750, Masai Johor

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A. INTRODUCTION

Industrial training for Diploma in Chemical Engineering allows students to acknowledge the types of work that chemical engineers do in the real life and understand the knowledge they have learned during diploma classes. It also encourages students to perform basic engineering practices such as technical writing reports, interaction with coworkers, project management, and proposal creation.

As a result, attending the industrial training helps students to expose themselves and learn new knowledge about the kind of companies that they will be working, which is at Water Treatment Plant Sultan Iskandar, Ranhill SAJ Sdn Bhd. It is a company that provide the internship for industrial training. The industrial training period started from 21 March 2021 and end on 15 July 2021. I got into the production department which produce water for area in Pasir Gudang.

This internship is beneficial to all especially for students. The work experience allows the industry to find and discover new employees while also improving the company's reputation among graduates. Interns, on the other hand, must ensure that all tasks assigned by the supervisor are executed correctly.

Interns are also expected to follow the company's norms and regulations with a sense of discipline. Most importantly, this program has the greatest positive influence on students since they were able to experience a real-life working culture, display continuous skill development, and be exposed to new knowledge with the support of industry specialists.

ii. History of the company

The location of Water Treatment Plant Sultan Iskandar is at Kampung Cahaya Baru, it is about 22 km from Pasir Gudang town center and 45 km from Johor Bahru city. This plant was built in 1984 and starts the operation on 1986 with a capacity of 181 MLD and it have been upgraded to 318 MLD in 1994. After that, in July 2018, the plant capacity has been upgraded to 358 MLD with the total area of 7.6 hectares. The overall of sites area includes Upper Layang and Lower Layang is 5550 hectares. The raw water sources of the plant are received from the upper laying Dam by gravitational force through 1600m pipe with a distance of 0.6km while the treated water will be pump to the the balancing tank at Bukit Lunchu, Masai Balancing and Sungai Buloh tank. The main raw water source which is supplying raw water to this plant is Upper Layang Dam, Lower Layang Dam, Sungai Johor and Sungai Tiram.

Figure 2: Water Treatment Plant Sultan Iskandar overview

Figure 3: Picture of Upper Layang Dam

Figure 4: Picture of Lower Layang Dam

The full supply level for the upper laying dam can have the full supply level until 27.3 meters, catchment area about 30.5sq.km and the total storage is 49.55 million m^3. While for the lower laying dam, the full supply level is only 6 meters, catchment area about 25 aq.km and the total storage is 15 million m^3. Other than that, the water treatment plant operates 24 hours a day with 3 operations technicians, 12 plant operators (3 person per shift), a laboratory assistant & 2 crew members. The average daily water output is 330 MLD. The areas that receiving clear water form this water treatment plant is the whole area in Pasir Gudang and part of Johor Bahru City which is Taman Molek and the Tebrau Industrial area.

The source of the electricity for the water treatment plant are from TNB's electricity supplies with 11kV and at the same time there is only one generator for standby purpose in the plant. But in case of any power disruption from TNB, the water treatment plant has 240 kVA generator as the support.

iii. **Process Flow for water treatment by Ranhill SAJ Sdn Bhd**

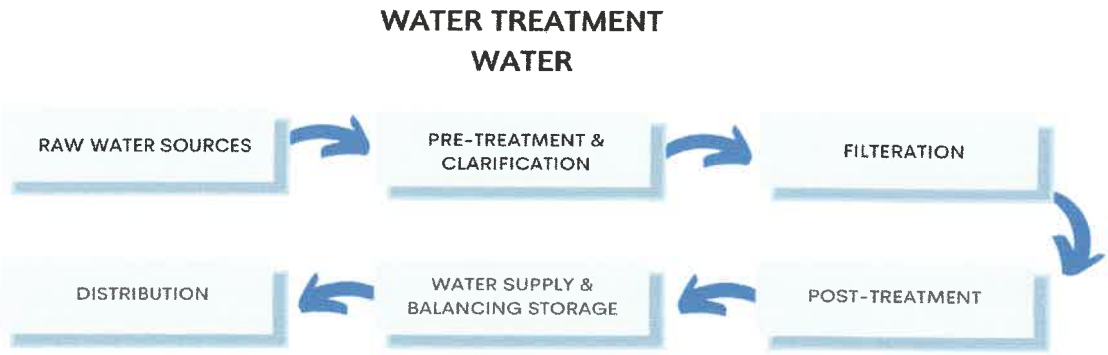


Figure 5: Water Treatment Flow Process

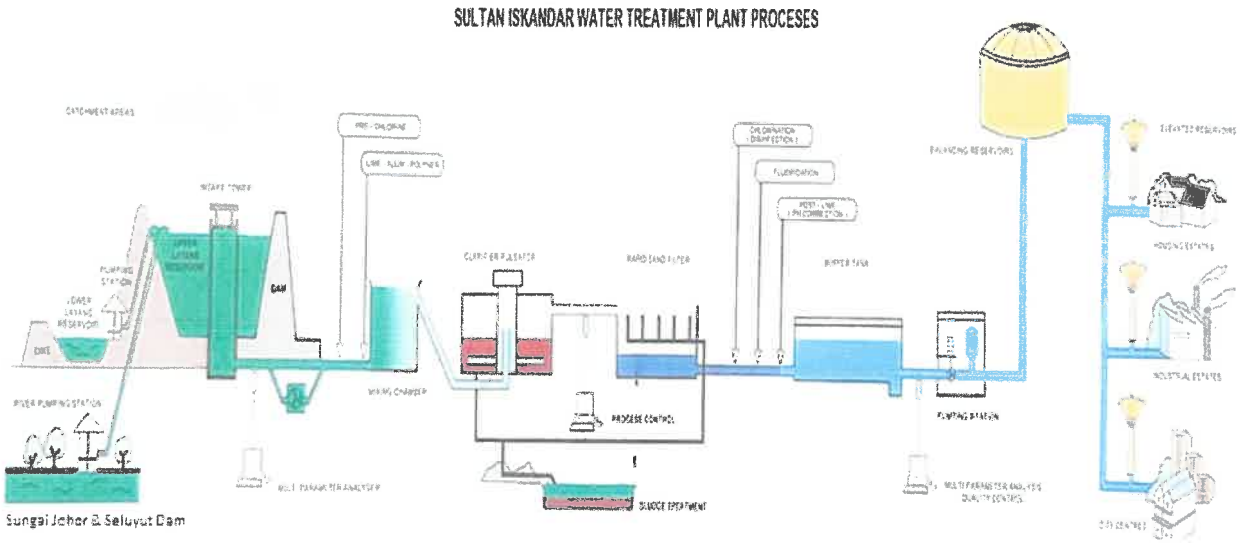


Figure 6: Picture of Sultan Iskandar Water Treatment Plant Process

1. Raw water

The water sources are derived directly from precipitation in the catchment areas with a dam storage into the Upper Layang Reservoir. The sources of the raw water are from the rain, discharge from Sungai Johor, Sungai Tiram and Lower Layang. After that, the raw water will be transferred to the Upper Layang Reservoir by gravity or booster pump. Catchment areas require regular monitoring and management on both their quality and quantity aspects.

2. Pre-Treatment & Clarification

The raw water will go through the pre-treatment process which is the pre-chlorine process. This pre-chlorine process is a process to kill the microorganisms and to treat the bad smells from the water. Next, the raw water will go to the mixing chamber by gravity. The booster pump will be use only when the water level is low.

In this mixing chamber, the aluminium sulphate and hydrated lime are added to separate the suspended solids from the clear water. The first process takes 3 minutes of rapid mixing. The process name is coagulation. During this coagulation process, the floc will happen, this is because the raw water contains negative charges while the aluminium sulphate contains positive charges.

Next, the water will flow to the clarifier. So, in the clarifier 17 minutes is needed for the slow mixing. This is where the floc from the coagulation process will gather and become bigger. After that, it will settle down at the middle of the mixing chamber as the clarifier have the lamella plate. The function of the lamella plate is to ensure that the floc would not sticks at the bottom of the clarifier for the more easier cleaning process of the clarifier. Lastly, the clear water will go into the pulsator while the waste product will go to the sludge lagoon for controlled dumping.

3. Filtration

The clarified water in the filter will go through the process in the filter which the water will go through the rapid sand filter. This filtration process is the last physical treatment which the purpose is to trap the small impurities. Filters are washed on regular basis by reverse flow of air and water. So, if the rapid sand filter clog in the filter, backwash of the sand filter will happen.

4. Post-Treatment

There are two post treatment for this water treatment. First post-treatment is a process called post-chlorine. This process is a last step to kill the pathogens left in the water. The second post treatment is by putting the fluoride in the water. The fluoride function is to strengthen the teeth and bone for the children under 15 years old.

5. Supply and Balancing Storage

To regulate the water supply, the clean water is pumped into large balancing reservoirs. There are 2 lines for the balancing tank, which the line 1 is going to Bukit Luncu Balancing Tank in Plentong and line 2 will do to Sungai Buloh balancing Tank in Pasir Gudang. They will act as a buffer between the production and distribution consumers. Other than that, they also will sustain any shortage distribution. This storage is called buffer tank.

6. Distribution

Treated water after that will be distributed to commercial and private consumers through the network of pipes supplied by balancing and elevated reservoirs. It will be distributed to the whole area in Pasir Gudang and part of Johor Bahru City which is Taman Molek and the Tebrau Industrial area.

C. INTERNSHIP ACTIVITY IN BRIEF

Week 1 – Week 4 (effective from: 21 March – 15 April 2021)

During this period in the internship, I am getting know and exposed about the environment of the company and after that got to know about the overview of the process in the first week. For example, at the first week I got to enter the Main Control Room and get to see the assistant technician doing the work in the real time. I also get the opportunity to visit package plant which is still on construction. The package plant is the addition of the water supply which will produce 20 MLD. It is still on construction due to the bad water quality results as the alum value is still high than the water quality guideline. In week 2, I started to be exposed myself in lab work, which I started by reading the procedures in how to identify the optimum coagulant dose, how to see ammonia and iron quality.

I also done few presentations in front of the lab assistant, Mr. Azmi. The presentations are to ensure that I know and understand about the water treatment plant and also about the experiment that need to be done in the lab. At that time, I learned how to make jar test and water quality control. Other than that, I learned about how to use pH probe, DR900 (water quality test machine) and also learn new knowledge which is how to use hydrometer. Next, in week 3, I started to do the jar test experiment and water quality control test by myself. Starting that, I started to do the test by myself, but Mr. Azmi always supervise me in the lab. I also visit the package plant during that time as Mr. Fairuz explained more detail about the process of

Figure 13: Workstation In Lab

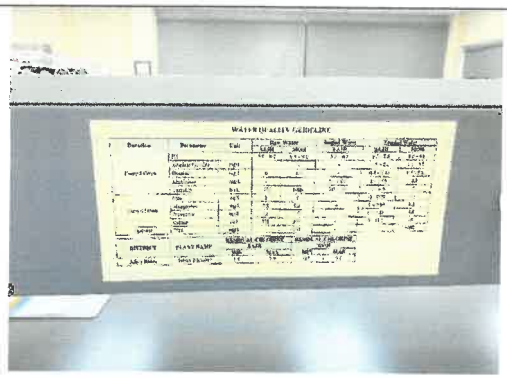


Figure 14: Water Quality Guideline

0Week 5 – Week 9 (Effective from: 18 April – 20 May 2021)

In this period of internship, I got to do more in office work. In this period, I was assigned the task to make which the task is from the headquarters. The task is under Leverage Knowledge Management which is to make the brochure for the water treatment plant as in figure 15. In this period, I also learned about ISO9001 which is from SIRIM, I learned how to do the files. As I proceed to do the office work, I learned about the method of installation of valve and short piece pipe at the lower laying water dam. Other than that, I also understand about the policy and safety of acid wash. This is during the filter backwashing. I also have been assigned to help the technicians to update some of the files in the filing room and use the correct template to make the record number and the tagging. The process of the filing took many days as there are so many files that need to be updated. I was assigned this task because it is as a preparation for the internal and external audit by HACCP and headquarters in July.

Besides that, I also was given a task to draw the package plant process flow diagram to revise back with Mr.Fairuz. The process flow diagram example is as shown in Figure 16. More work experience I get during this period is, I got to access RAMBO System which is a system to make staffs overtime payment. I was assigned to fill in the worker overtime payment to send it to the headquarters. Other than work experience, I also get to feel the "gotong-royong" together with all of the staffs. This event only happens once in a year. During that activity, we were making Eid Aidilfitri Food together. The activity took a whole day on 10 May 2021. Lastly, before headquarters assigned intern students to work from home, I got an assignment which

is to make an excel about calculation of aluminium sulphate by manager and the task need to be sent on 1 July 2021.

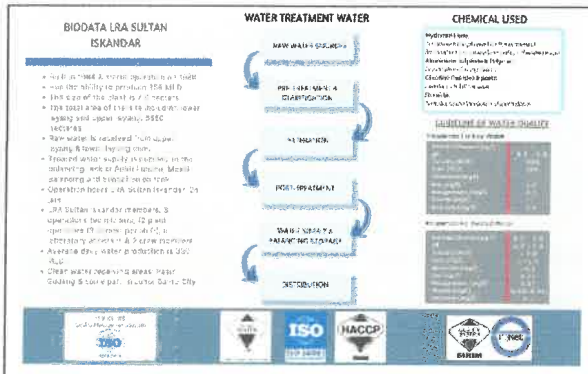


Figure 15: Leverage Knowledge Management Task

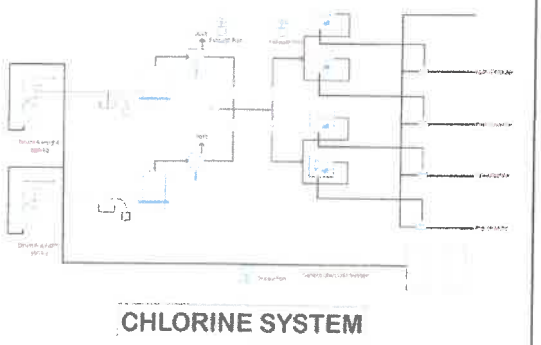


Figure 16: Process Flow Diagram Of The Chlorine System In The Package Plant (Example Of The PFD Drawn)

Figure 17: RAMBO System

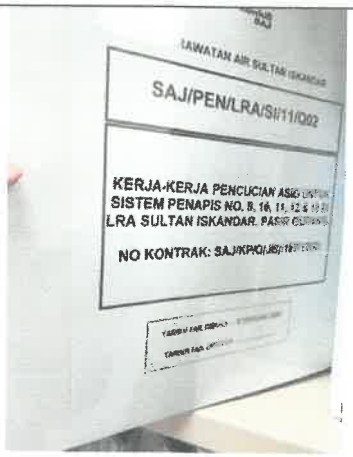


Figure 18: Example Of File That Need To Be Update

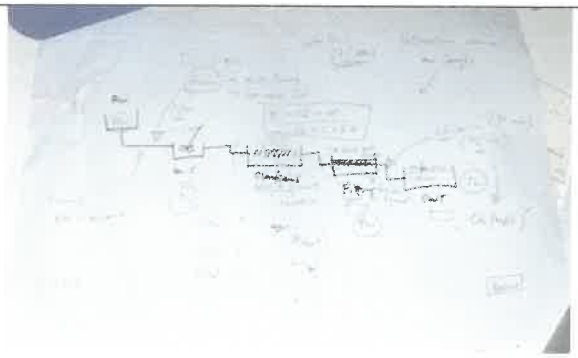


Figure 19: Task given by manager to make the calculation for alum	Figure 20: Making Eid Aidilfitri Food together with all of the staffs.

Week 10 – Week 17 (Effective Date: 23 May 2021 – 15 July 2021)

In this period, I am going through work from home as the government announce the Movement Control Order (MCO). The order is from headquarters letter. So, during this time I help the staff on the work that I can do at home and also do the easy calculation of alum task. Unfortunately, during this period Mr. Fairuz wanted to teach more about the package plant, but it has been canceled due to the situation. When working from home, the environmental of work have become different. I do the calculation task that have been assigned. Before doing the assignment, I recalled and study back mass balanced subject. I also searched for articles that can help me to calculate but unfortunately, there is not many articles about that. I also watched some calculation videos to help me to do the assignment.

After that, from all the information that I already get, I transfer them in the Microsoft Excel. In the Microsoft Excel, I started to do the calculations for alum. The conclusion from the calculation that I made is, to use 48 ppm of liquid alum with 21.02 ppm of hydrated lime needed to be use. But the calculation in is only the theoretical. The amount of hydrated lime use in the water also can be different than that because it also follows the condition of the raw water as well. The assignment also has been sent and received by the manager as shown in figure 21 and figure 22. Other than the assignment, I also help to email the memos from the headquarters and also making the letters about Movement Control Order (district cross) for the staff. I also study about sand filter acid clean (SFC 210) from the chemical safety data sheet from Chemkimia Sdn. Bhd. The data sheet is divided into 16 sections, and it have all of the information for the SFC 210.

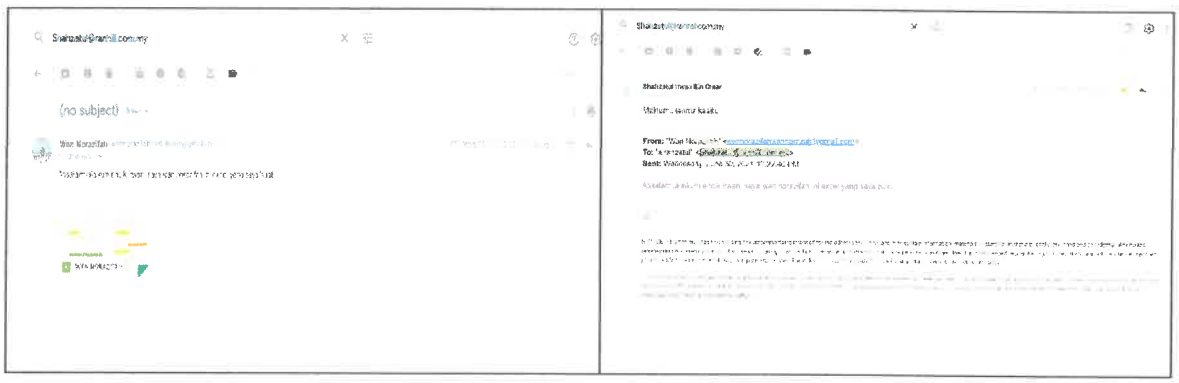


Figure 21: Proof of the email have been sent to manager

Figure 22: Proof of manager received the assignment

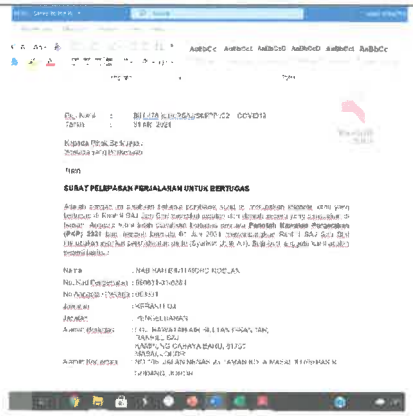


Figure 23: The example letters that need to be make for all the staffs

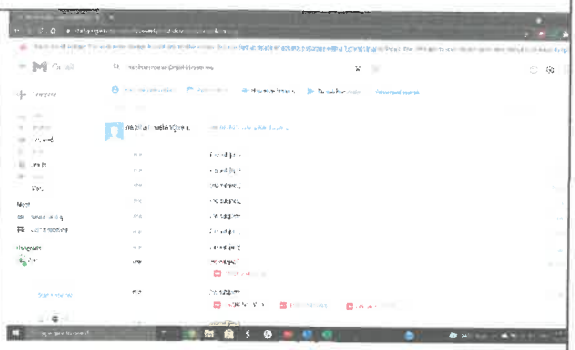


Figure 24: Email the memo and the letters from headquarters to the clerk

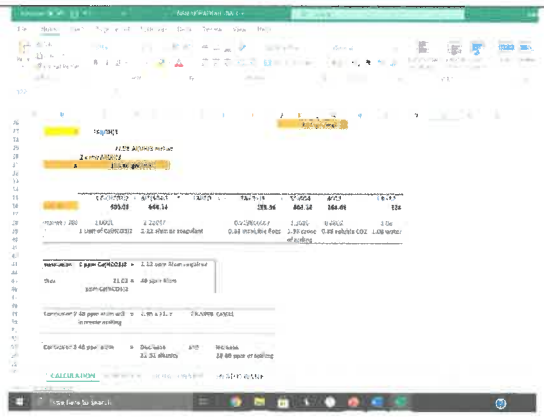


Figure 25: The overview of the calculations of the alum

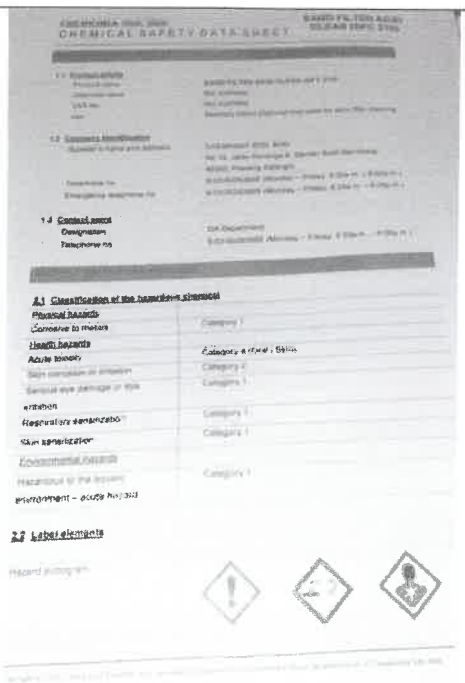


Figure 26: The chemical safety data sheet for sand filter acid clean

D. TASK THAT HAS BEEN ASSIGNED (MINI PROJECT)

The first task that I got during internship is to presentation about the water treatment plant to Mr. Azmi (lab assistant). First, Mr. Azmi taught about the water treatment plant in front of me in the lab. He asked to present back about what he have talked about in front of him. He asked me to do that because he wants to know that either I understand or not the lesson that he teaches me.

Next, I also received a task to be in the lab to do jar test as in the figure 7. The jar test needs to be done in every 3 shift which is morning, afternoon and the night shift. I only done the morning and afternoon shift as the two shifts are in the office hour. For the night shift, the staff in charge will do the jar test experiment. The jar test experiment is a simulation to find out the optimum dose for the coagulant to use. The jar test is a real simulation for the water treatment plant. For example, the time of rapid mixing of the aluminium sulphate and hydrated lime is 3 minutes same as in the mixing chamber and after that 17 minutes needed for the slow mixing in the clarifier. In this jar test experiment, there will be coagulation and flocculation process happened. This coagulation and flocculation happened because the charge for the raw water is negative charges and the aluminium sulphate is positive charges that will form the floc. So, to find the right optimum dose, I need to pay attention to the floc that settle down first. So, for the Sultan Iskandar Water Plant, the flocs that settles down first is at dose 48 ppm. After the test settled, I need to fill the form of jar test to be send to the assistant technician.

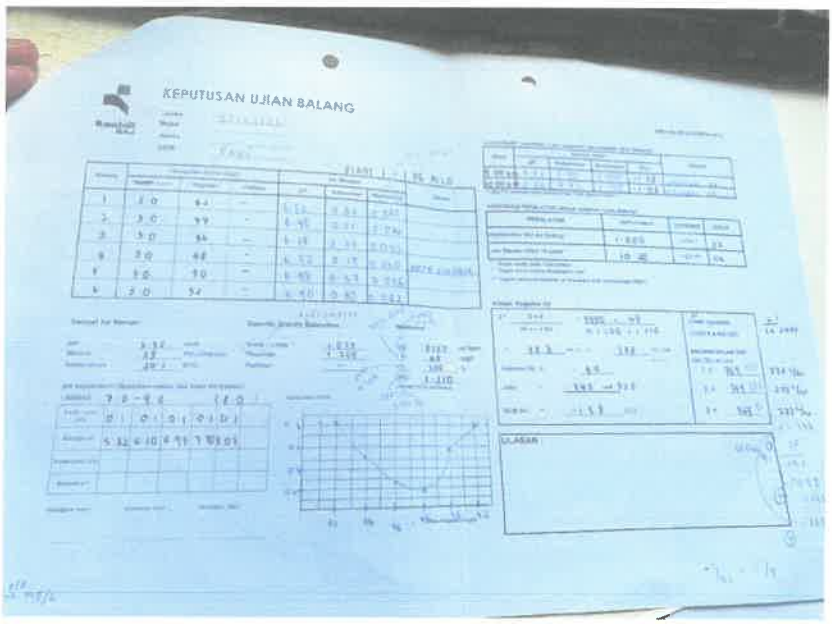


Figure 27: The Jar Test Form

The next task is for me to do the water quality test. The quality test is to investigate the quality of the pH, turbidity, colour, aluminium sulphate, iron, ammonia, manganese, fluoride and chlorine for the raw water and treated water. This water quality test needs to be done every 2 hours except for aluminium sulphate, ferum, ammonia and manganese which need to be done in every 4 hours. The device uses to check the water quality is using DR-900 as shown in figure 12. The chemical needed to be put to make the experiment is as in the figure 28. I simplify the procedure and make it into the mind map as it is easier for me to see when doing the experiment. Each of the box represents the test tube that will be put at the test tube rack. After making each of the test, I need to check with the guideline given as shown at figure 14.

If the quality is higher than the guideline given, I need to immediately tell the operator so they can fix the problem. For example, if the quality of the chlorine is more than 2.2 mg/l the operator will insert lesser chlorine in the water. But, thankfully during the period I do the water quality test, there is no quality that more than the guideline. If the quality more than the guideline, the water treatment plant will receive a water violation letter from the headquarters at Larkin. After I done the test, I need to send the picture of the quality test to Mr. Azmi (lab assistant) as in figure 29 for treated water alum test, treated water fluoride test and treated water chlorine as the proof that the test has been done during that hour. Lastly, I need to fill the form of water quality control and need to be approved by assistant technician as shown in the figure 30.

Blank Alum: treated water + ascorbic acid -> bleaching	Treated alum: treated water + ascorbic acid -> aluver	Blank Alum: raw water + ascorbic acid -> bleaching	Raw alum: raw water + ascorbic acid -> aluver	Blank Fe: Raw water	Raw Fe: Ferro Ver Iron	Blank Fe: Treated water	Treated Fe: Ferro Ver Iron
Blank Flouride: Distilled water + SPADNS	Treated flouride: Treated water + SPADNS				Blank ammonia: distilled water + ammonia salicylate + ammonia cyanurate	Raw ammonia: raw water + ammonia salicylate + ammonia cyanurate	Treated ammonia: treated water + ammonia salicylate + ammonia cyanurate
Blank chlorine: Treated water	Treated chlorine: Treated water + DPD Free Chlorine	Color Blank: distilled water	Color raw: raw water	Color treated: treated water	Blank manganese: distilled water + ascorbic acid + botol putih + botol merah	Raw manganese: raw water+ ascorbic acid + botol putih + botol merah	Treated manganese: treated water+ ascorbic acid + botol putih + botol merah

Figure 28: The steps and chemical need to be added to do the water quality test.

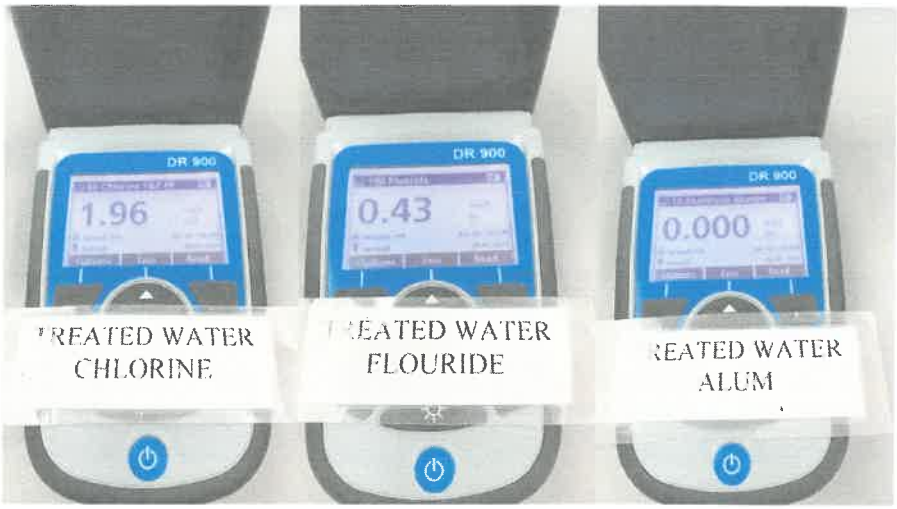


Figure 29: The proof of the water quality test that have been done.

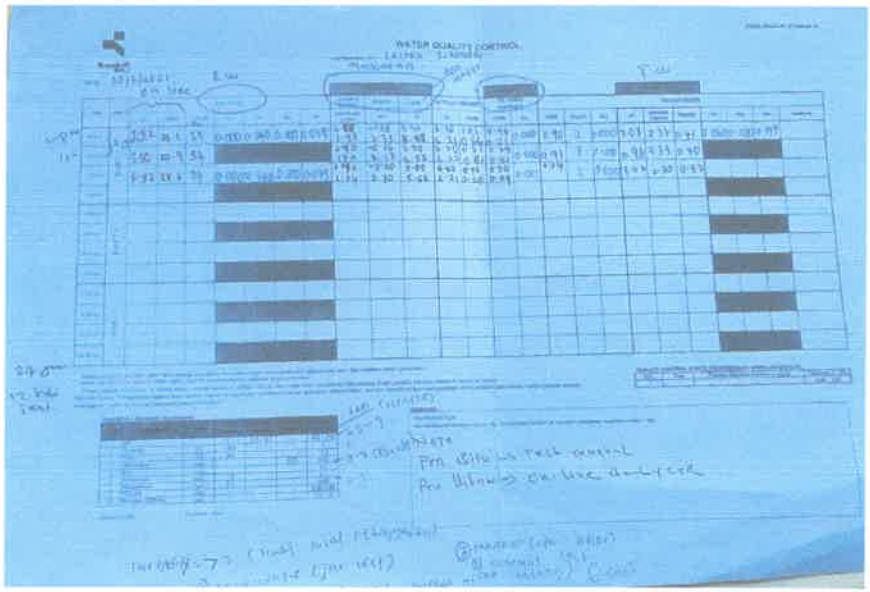


Figure 30: The example of the water quality control form.

Next task that I have been assigned is to do a brochure for the Leverage Knowledge Management for the visitors in the water treatment plant as in figure 15. The making of this brochure takes lots of changes in the aspect of design and the word contain in the brochure. After the brochure done, Mr. Kamal checked everything and after that sent the done brochure to headquarters. In the brochure, it has the information of the plant such as the process, the history and how many consumers that use the plant service. I also learned new thing when making the brochure which is I learned about the history of the water treatment plant.

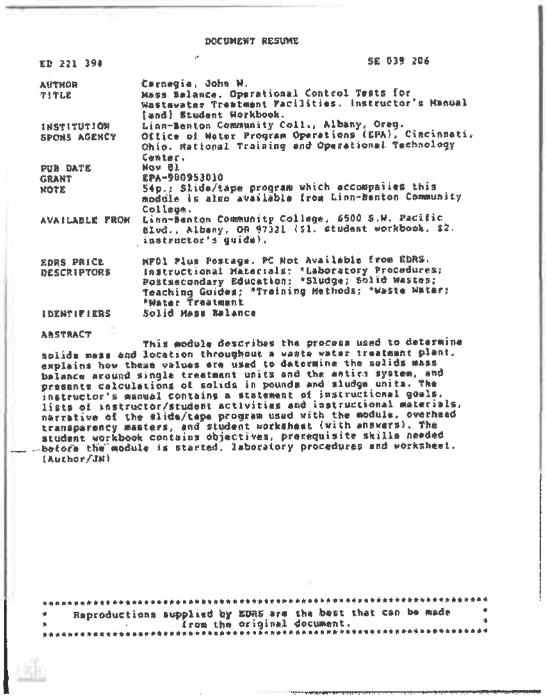
I also have a task to do research about polyaluminium chloride but need to be stop as the experiment still need to be handled by more experience person because polyaluminium chloride need to be handled carefully. But I still see the process that the lab assistant and the operator do. I see how they try an error to receive the good optimum dose for the polyaluminum chloride. The optimum dose for the experiment achieves at 24 ppm. That was the best optimum dose. The experiment was done in 3 days by Mr. Azmi and the operator.

The fifth task is I need to draw the PFD of the package plant as in figure 16. The process flow diagram needs to be drawn are such as the main overview of the package plant process, the polyaluminium chloride (PAC), pre and post sodium hydroxide process and the chlorine system. I need to draw this process flow diagram because Mr. Fairuz want to explain more detailed on the new package plant, but due the package plant construction and MCO, the plan needs to be cancelled by Mr. Fairuz.

Lastly, during my work from home period, I have received an assignment which is to calculate easy calculation on the aluminium sulphate using Microsoft Excel. Aluminium sulphate is the coagulant choice for the water treatment process in Sultan Iskandar Water Treatment Plant. This is because aluminium sulphate is effective in clarification process and alum also offers a good turbidity removal. So, to make the task, I recalled and referred some of the mass balance notes to remember the calculations. I also search for the articles but unfortunately only few articles that can be found and only one articles that have detailed calculation in it. The articles that have the calculation is *Mass Balance. Operational Control tests for wastewater treatment facilities* as shown in figure 30. I also watched YouTube videos to search the related calculations for the task.

After I got some idea how to calculate the mol weight of alum, I started to gather the information need to make the calculations. The chemical equation for the calculation is $\underline{3\ Ca(HCO_3)_2 + Al_2(SO4)_3{*}14H_2O \rightarrow 14\ H_2O + 6\ CO_2 + 2\ Al(OH)_3 + 3\ CaSO_4}$. The first calculation that I make is to calculate the molecular weight of each element. The result of the calculation is as shown in figure 31 and 32. There are 2 conclusion gains from this calculation which the first one is for the removal of 1 ppm hydrated lime alkalinity require 2.22 ppm of alum. Thus 21.02 ppm of hydrated lime needed for 48 ppm of alum. 48 ppm of alum refers to the quantity of the alum use in the mixing chamber. The second conclusion is the 48 ppm of the alum will decrease 21.02 alkalinity and will increase 28.60 ppm of the permanent hardness. The hydrated lime as in the chemical equation is used to raise the pH of low alkalinity waters and alum also tends to work best at the water pH 6.5 – 7.5. Lastly, after the calculations have been

done, I emailed the task to Mr. Irwan, the manager of the water treatment plant on 1 July 2021 as in the figure 21 and Mr. Irwan received it as in figure 22.



DOCUMENT RESUME

ED 221 398 SE 039 206

AUTHOR	Carnegie, John W.
TITLE	Mass Balance. Operational Control Tests for Wastewater Treatment Facilities. Instructor's Manual [and] Student Workbook.
INSTITUTION	Linn-Benton Community Coll., Albany, Oreg.
SPONS AGENCY	Office of Water Program Operations (EPA), Cincinnati, Ohio. National Training and Operational Technology Center.
PUB DATE	Nov 81
GRANT	EPA-900953010
NOTE	54p.; Slide/tape program which accompanies this module is also available from Linn-Benton Community College.
AVAILABLE FROM	Linn-Benton Community College, 6500 S.W. Pacific Blvd., Albany, OR 97321 ($1, student workbook, $2, instructor's guide).
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	Instructional Materials; *Laboratory Procedures; Postsecondary Education; *Sludge; Solid Wastes; Teaching Guides; *Training Methods; *Waste Water; *Water Treatment
IDENTIFIERS	Solid Mass Balance

ABSTRACT

This module describes the process used to determine solids mass and location throughout a waste water treatment plant, explains how these values are used to determine the solids mass balance around single treatment units and the entire system, and presents calculations of solids in pounds and sludge units. The instructor's manual contains a statement of instructional goals, lists of instructor/student activities and instructional materials, narrative of the slide/tape program used with the module, overhead transparency masters, and student worksheet (with answers). The student workbook contains objectives, prerequisite skills needed before the module is started, laboratory procedures and worksheet. (Author/JN)

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*	from the original document.	*

Figure 30: Article of Mass Balance. Operational Control tests for wastewater treatment facilities.

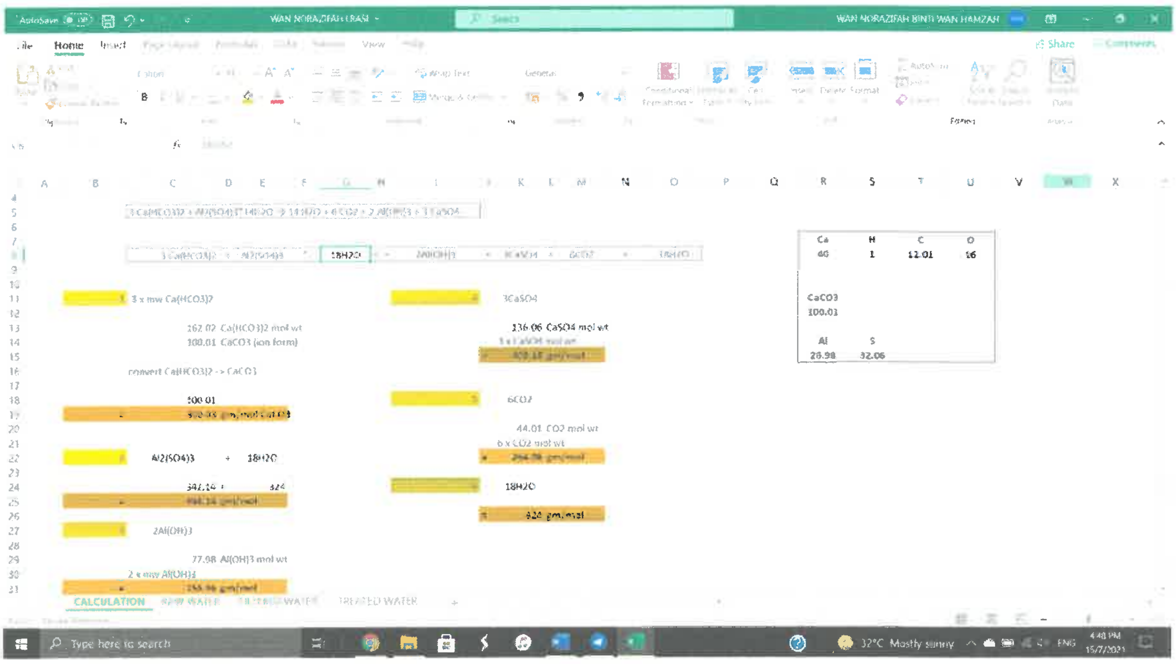

Figure 31: The calculations of the alum dosage in the water.

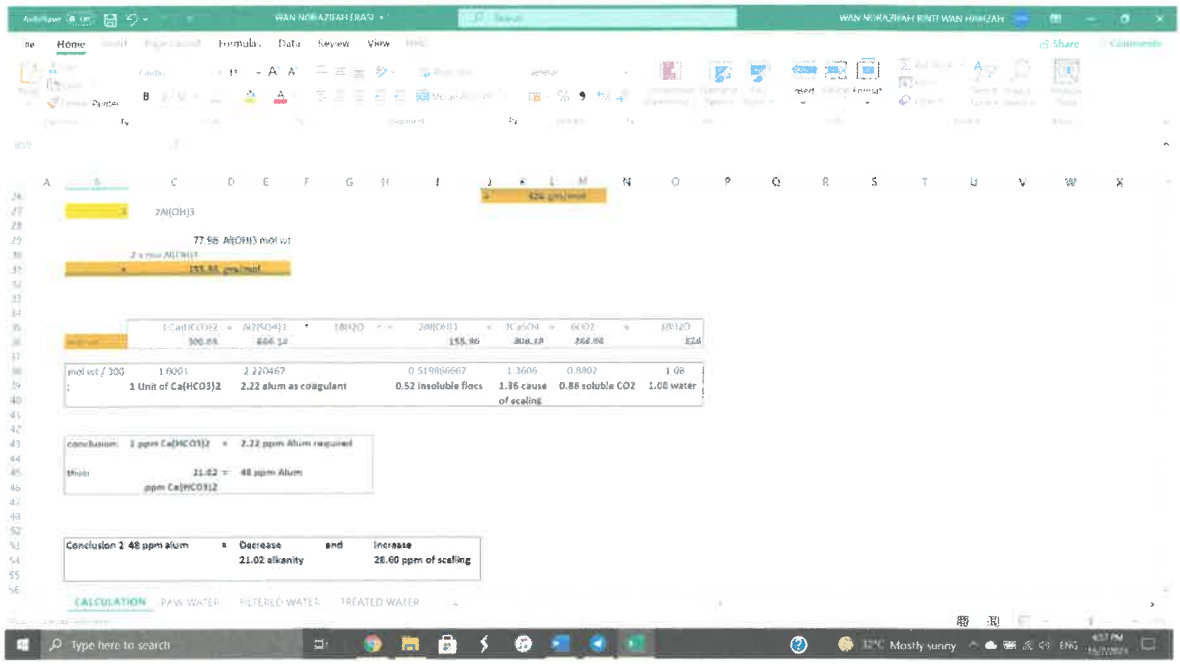

Figure 32: The calculations of the mol weight and the conclusion of the calculation.