UNIVERSITI TEKNOLOGI MARA

LEMBAGA AIR PERAK

INDUSTRIAL TRAINING FINAL REPORT

SESSION: 2 2022

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Duration (Date)	:	22/08/2022 – 03/02/2023
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ABSTRACT

This industrial training report of Nur Farah Anisah Binti Radzuwan is to undergo industrial training for a period of 6 months which consists of 24 weeks before completing the Diploma courses. Starting industrial training at Lembaga Air Perak on November 1, 2022, and ending on February 3, 2023, under the direction of En. Norzaimi Bin Harun.

The goal of this program is to fulfill the requirements to receive the Diploma and graduate from the university. Prior to graduation, training refers to work experience that is relevant to professional development. The first chapter of this report defines the term industrial training and describes the objectives of industrial training. This section describes the objectives of the industrial training report and the industrial report in detail. The second chapter of the report provides an overview of the company and its departments.

The summary of the responsibilities and numerous tasks in weekly industrial training activities are covered in the following chapter. The subsequent chapter discusses the specifics of the experience and knowledge obtained, difficulties faced and methods for solving them, professional and ethical concerns, and topics relating to health, the environment, and sustainability. Last but not least, the conclusion of all the reports, proposals, and recommendations to the Lembaga Air Perak is in the final chapter.

Last but not least, this training provides students with positive exposure to real-world opportunities to contribute to the company's projects. There are some input parameters offered, in addition to expanding knowledge not discovered in studies. In addition, I was introduced to the realities of working in the real world, or, to put it another way, students can put what they have learned in the classroom and via training to use. Students may find it simpler and receive real work after finishing their studies as a reward. In addition, this training has aided numerous students in self-evaluation in a number of crucial areas of discipline, sense of responsibility, teamwork, and personal growth, which is a crucial part of the workplace.

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CHAPTER 1

INTRODUCTION

1.1 Overview

Industrial Training (IT) is a mandatory requirement for students in certain programs at all levels of higher education at Institutions of Higher Learning (IHL). Industrial training programs were introduced to strengthen the competencies required to increase the level of graduates' ability to work. Industrial Training (IT) refers to exposing students to real-world engineering experiences and getting them involved in Chemical Engineering projects before graduation. One of the requirements for the award of a Diploma in Chemical Engineering is that the student complete at least twenty-four (24) weeks of Industrial Training with 12 credit hours within semester six (6) OR after passing all of the courses taken from semester one to semester five.

Industrialmanship aims to introduce UiTM students to industrial culture and working environments while also increasing students' employability by enhancing their industrial skills. They will also go through several briefings as guidance for the trainee. This internship will last 24 weeks, beginning on August 22, 2022 and ending on February 3, 2023. The student must report to the company at the time and date specified during the Industrial Training briefing. During the internship period, each student will be assigned one (1) Lecturer Evaluation to evaluate their performance. The logbook and finalized report are due to the college two (2) weeks after the internship ends, both online and in hard copy.

Industrial Training (IT) courses provide students with hands-on learning opportunities in the workplace to improve market reliability. Industrial training aids in the preparation of students for careers as engineering technicians by producing chemical engineering technician graduates with excellent technical skills and soft skill competency. Theories learned in all core and non-core courses can be applied by students in industrial training, so it is expected that students will be able to solve the problem or project assigned by supervisors creatively and innovatively. Furthermore, industrial training helps students gain confidence, and improve communication, and teamwork skills. In addition, students are expected to exhibit a high level of integrity, ethics, and accountability in engineering practice.

As a Diploma in Chemical Engineering student at UiTM Pasir Gudang's Department of Chemical Engineering, I am mandated to fulfill the industrial training assessment requirements. Chemical Engineering students, in this case, need to be exposed to the working world and practice for life after graduation. Students will be placed in either private companies or government departments to be trained in a working environment that is very different from what they experienced in college. It will provide a large platform for students to examine and learn more about themselves to mentally and physically prepare for their future.

Students will face a variety of difficulties assimilating into the current system during their industrial training phase. I participated in the industrial training program at Lembaga Air Perak, which is renowned for offering possibilities for education and research in the field of water utilities, for 24 weeks starting on November 1st and ending on February 3rd, 2022. I learned new things at work and was exposed to new things, particularly regarding the working atmosphere, which I felt was a very unfamiliar condition for me to handle. I could put into practice what I had learned in the lecture and recognize the supplies and tools utilized in the lab. The opportunity allowed me to understand the genuine nature of the job was the most significant component of the training. In addition, it has broadened my knowledge, helped me think more critically about how products are made and helped me find solutions to challenges I have at work. It also helped me feel more confident in myself and started to think I could make it in a new working environment.

1.2 Objective Industrial Training

The primary goal of Industrial Training (IT) is to provide students with opportunities to learn in the working world and gain practical experience to improve market reliability. Industrial training facilitates the preparation of students for careers as engineering technicians by producing chemical engineering technician graduates with excellent technical skills and soft skill competency. The following are the other goals:

- Mastering technical skills
- Gaining essential background knowledge
- Perfecting interpersonal skills (soft skills)
- Building a Network of Contacts

1.3 Industrial Training Placement

1.3.1 Industrial Schedule

Table 1.1 : Industrial Schedule

Normal working hours	8 hours
Day of working	5 days a week
Work in	8:00 am
Break hour	**Monday – Thursday** 1:00 pm to 2:00 pm **Friday** 12:15 pm to 2:45 pm
Work out	5:00 pm

1.3.2 Company Supervisor Information

CHAPTER 2

COMPANY PROFILE

2.1 Company Background

Figure 2.1 : Lembaga Air Perak

Lembaga Air Perak (LAP), located on St. John Street, is a responsible company that provides clean water to the public by arranging quality international standard services that are viable and deliver value. To guarantee that LAP always provides customers with the services they anticipate, the laboratory's integrated quality management system was based on MS ISO 9002: 2000 in its services and daily activities. To accomplish a more efficient system, the laboratory was also honored with the Malaysian Laboratory Accreditation Scheme for its success in meeting the ISO/IEC Guide 25 requirements. Furthermore, the LAP laboratory employs ISO 17025, which aligns all standard methods for chemical and physical water testing.

Lembaga Air Perak (LAP) is headed by a general manager who is the Chief Executive of the Board and is accountable for implementing all plans, schemes, or initiatives as well as the Board's decisions and the Chairman's directions. General Manager, who is elected by the Board of Directors, is in charge of the Perak Water Board's operational, financial and administrative issues. Lembaga Air Perak (LAP), which provides clean water to over 2.5 million people, is Malaysia's third biggest water operator after Selangor and Johor.

Following the goal of LAP and its obligations under Act 655, treated water must meet the Ministry of Health's (MOH) National Standard for Drinking Water Quality through water sampling and testing for physical, chemical, and microbial criteria. LAP, in conjunction with the Health Department of the state of Perak, conducts water sampling as part of the National Drinking Water Quality Surveillance Programme. In the state of Perak, there are 540 treated water sample stations in the distribution system and 55 raw water monitoring points under this program. Water samples are collected at these sampling points and delivered to the Chemistry Department for testing.

Table 2.1 : Operating Schedule of Lembaga Air Perak

Days	**Working Time**
Monday to Thursday	8:00 am – 1:00 pm 2:00 pm – 5:00 pm
Friday	8:00 am – 12:45 pm 2:15 pm – 5:00 pm
Saturday & Sunday	Weekend holiday

2.2 Company History

Lembaga Air Perak (LAP) was founded as a State Statutory Body agency on January 1, 1990, after the approval of the Perak Water Board's 12^{th} Enactment in 1988 and responsible for the construction, management, and installation of water supply in Perak. Prior to that date, water supply issues were handled by the Water Supply Department (JBA), which was formed to take over all water supply affairs from Jabatan Kerja Raya (JKR), State of Perak. The JBA administration was divided into 9 districts as District of Kinta, Perak Tengah, Manjung, Batang Padang, Hilir Perak, Larut Matang & Selama, Kerian, Kuala Kangsar, and Hulu Perak.

Malaysia's water sector was restructured in 2008 to address CAPEX finance concerns. Water operators in Malaysia will now operate as an asset-light corporation as a result of the reorganization. PAAB was established as a special-purpose corporation to offer CAPEX finance to state-owned water utilities.

2.3 Customer Charter

- The latest water supply will be linked to the user's premises within 7 days of the installation of the water supply and payment of all fees, including the deposit.
- All verbal enquiries about bills will be dealt with within one day.
- Water supply will be reconnected within two days of the user's complete payment of water bill arrears and charges.
- The deposit for the water supply account will be returned to the customer in cash or cheque within two months after the account's termination date.
- Water supply outages will be reported through public or social media at least three days before incidents occur.
- Actions to fix broken or leaky water distribution pipes shall be conducted within one day of receiving the report.
- Action to the application for approval of water reticulation plans should be made within 3 to 4 weeks after receiving.
- Provide full equality to all consumers when delivering water supply services.

2.4 Vision and Mission

Vision:

We will accomplish our purpose by growing into an effective and accountable business that aspires to:

- Be a pioneer in Malaysia's domestic industry.
- Provide our consumers with high-quality service.
- Administer the business with the highest regard for public health, safety, and the environment.
- Adding value to the enterprise's stakeholders.

Mission:

Supply clean water for all citizens, both within and outside of the city, as well as the commercial and industrial sectors.

2.5 Values

Lembaga Air Perak (LAP) adheres to the following values in order to execute the mission and realize the vision:

- Cooperation and teamwork
- Recognize and address the demands of the customers.
- The requirement to limit waste, particularly water loss, does not act at a tolerable level.
- The significance of timely and adequate information for management and control at all levels.
- Maximum utilization of technology
- Communication that is clear and transparent
- Possibilities for career development and personal growth.
- Environmental sensitivity and care

2.6 Board of Directors

1. YAB. Dato' Seri Hj. Saarani bin Mohamad
   (Chairman)

2. YB. Dato' Ahmad Suaidi Bin Abdul Rahim
   (Secretary of the State Government of Perak Darul Ridzuan)

3. YB. Dato' Azmir Shah bin Zainal Abidin
   (Perak State Legal Adviser Darul Ridzuan)

4. YB. Dato' Zulazlan Bin Abu Hassan
   (Perak State Government Finance Officer Darul Ridzuan)

5. YB. Dato' Haji Mohd Zolkafly bin Harun
   (Chairman, Perak State Infrastructure, Energy, Water and Public Transport Committee)

6. YB. Dato' Zainol Fadzi Bin Haji Paharudin
   (Chairman, Perak State Rural Development Committee, Entrepreneur Development and Cooperatives)

7. YB. Dato' Haji Mohd Tarmizi bin Haji Idris
   (ADUN Kenering)

8. YB. Dato' Haji Zainun bin Haji Mat Noor
   (ADUN Chenderoh)

9. YBhg. Dato' Iskandar Dzulkarnain bin Abdul Khalid

10. YBhg. Dato' Ir. Mohd Yusof bin Mohd Isa

11. YBrs. Dr. Najihatussalehah binti Ahmad

2.7 Organization Chart

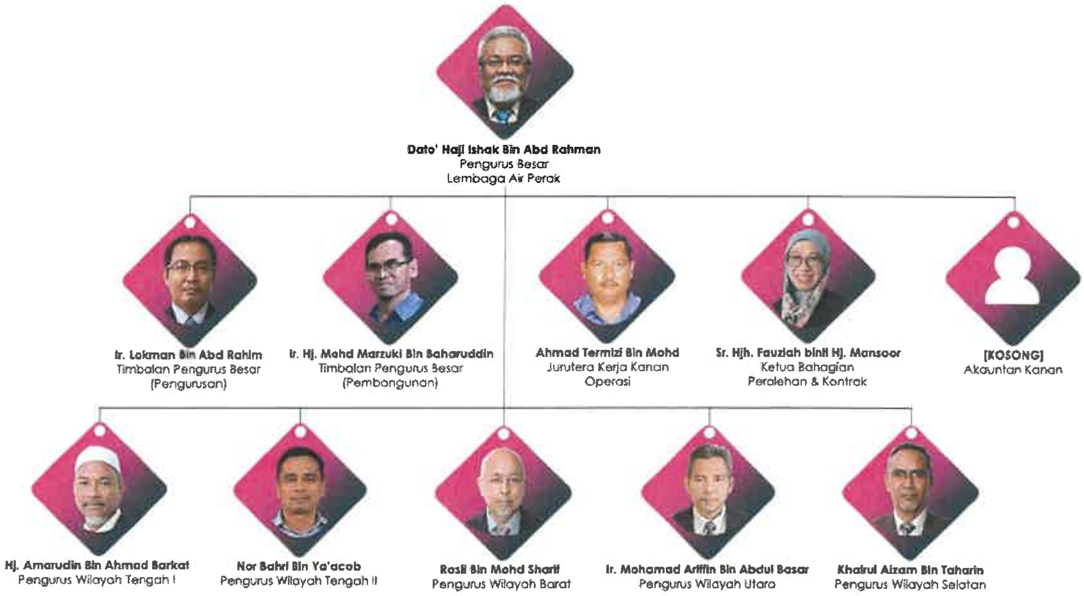


Figure 2.2 : Organization Chart for Lembaga Air Perak

Figure 2.6 shows Lembaga Air Perak's (LAP) organization chart for 2022. LAP has 45 management officers and professionals, as well as skilled and devoted workers in all divisions and administrative areas, to carry out the job. LAP now employs a total of 1,119 employees. LAP's organizational structure is divided into five main sections which are Corporate Affairs, Financial Control, Operations, Development, and Business Management with the functions and tasks of each section:

1. Corporate Affairs
    1. Information technology management
    2. Public relations
    3. Management and daily administration of the Lembaga Air Perak (LAP)
    4. Dealing with matters related to legal issues
    5. Responsible for managing deposit and assets
    6. Responsible for logistics management and job security
    7. Responsible for managing Management Human Resources, Staff Welfare and Employee Health
    8. Responsible for managing security physical

2. Financial Control
    1. Responsible for preparing the budget yearly
    2. Manage these matters expenses, loans, wages and receipts of money
    3. Manage assets and investments
    4. Data processing and bulk systems
    5. Revenue reconciliation and bank reconciliation
    6. Prepare annual financial reports and cash flow
    7. Control in terms of expenses and costs
    8. Responsible for system control accounting and billing systems

3. Operations
    1. Prepare, review and analyze costs of production
    2. Manage operations and maintenance water treatment plant
    3. Manage and maintain the system water distribution
    4. Ensure the quality of water produced according to established standards and operations are at an efficient level
    5. Develop strategies to reduce NRW
    6. Monitor NRW reduction performance

4. Development
    1. Responsible for planning and implementing approved projects
    2. Arrange and coordinate funds for financing projects
    3. Supervise project implementation
    4. Manage contracts and tenders issued by the Lembaga Air Perak (LAP)

5. Business Management
    1. Manage related matters with billing operations
    2. Manage related matters with revenue collection
    3. Responsible for enforcement of water supply regulations
    4. Responsible for others' supply-related services water

6. Internal Audit
    1. Responsible for ensuring travel operations and finance comply with procedures designated

2.8 Regional Map

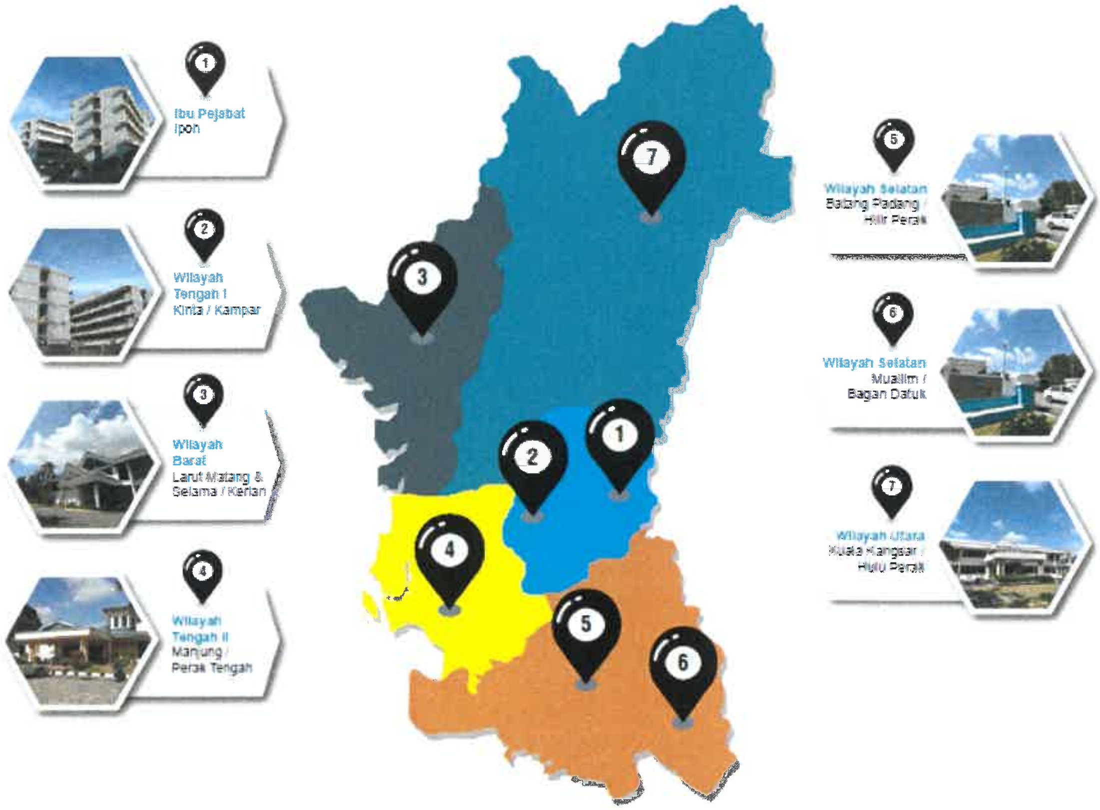


Figure 2.3 : Lembaga Air Perak regional map

2.9 Water Treatment Plant Location in Perak

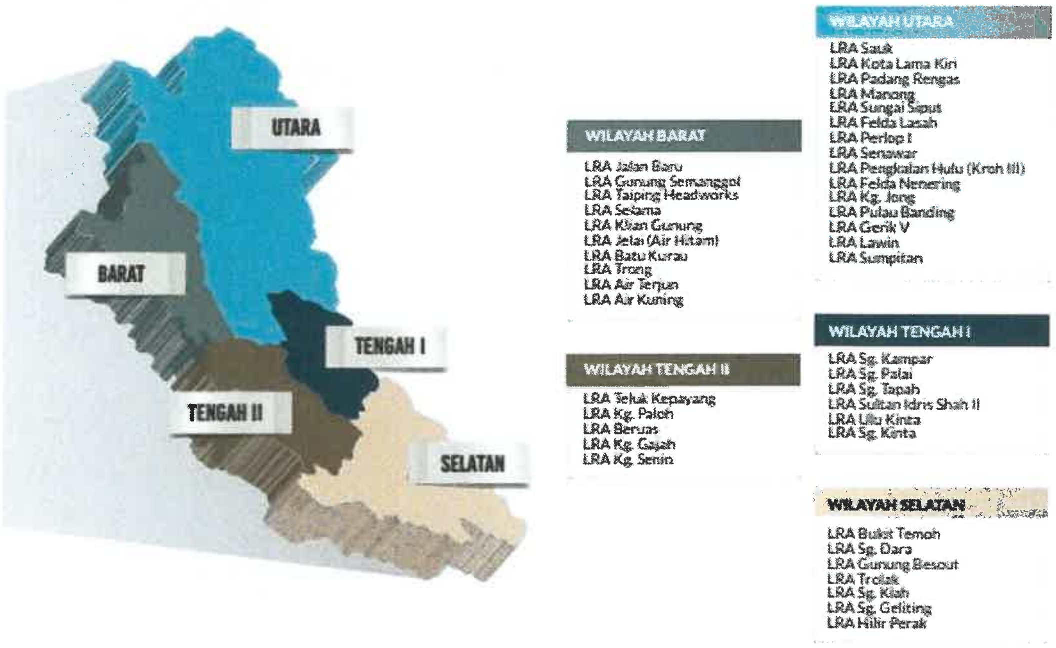


Figure 2.4 : Water Treatment Plant Location in Perak

2.10 Main Service Provided to the Client

The sources of water used for treatment in Perak were essentially everything from rivers, with some coming from dams, lakes, or channels. The water supply is becoming more polluted, and the quality is not acceptable. Impurities in water have a negative impact on consumers. As a result, polluted water must go through a proper quality treatment procedure before being supplied to consumers as drinking water and must adhere to National Drinking Water Quality Guidelines.

The water provided to Lembaga Air Perak (LAP) is treated using the conventional water treatment method. However, some plants do not yet have a fully functional conventional water treatment system. Coagulation and flocculation, sedimentation, filtration, chlorination, pH adjustment, and fluoridation are examples of plants that have a full conventional treatment system that includes all water treatment processes. A plant with a semi-full treatment system does not have all of the treatment processes, such as sedimentation and chlorination.

The State Water Authority, LAP, has been assigned with supplying and ensuring the supply of treated water for the home, commercial, and industrial sectors in the State of Perak to always be assured by implementing sustainable development and comprehensive planning. Raw water from the sources will be sent to water treatment plants for disinfection. Then, only clean and purified water would be supplied to Perak residents. Screening, aeration, coagulation and flocculation, sedimentation, filtration, and disinfection procedures are widely utilized in these water treatment facilities under LAP administrative service operation.

LAP will ensure that the water delivered is always safe and clean once it has been treated and clean water has been given to customers. Every month, water quality tests will be performed at the water treatment plants. Typically, the test criteria used include pH, turbidity, color, and chlorine balance. Water samples were collected from plants and distribution systems for bacteriological and chemical testing as part of the National Drinking Water Quality Control Program. This is to ensure that the water delivered is safe and suitable for any purpose and that the LAP aim is fulfilled.

2.11 Flow Chart of Operation

This company's service operation is to cleanse water and provide clean water to users across Perak, as well as to ensure that the supply of water is always in satisfactory quality according to ISO standards. More information on the company's water treatment process flowchart may be found in the **Appendix B-PK-(P)-01**.

1. The water treatment flow process commences with measuring or raw water testing. If this test fails, the raw water supply will be halted, and corrective action will be performed.
2. Once the adjustment has been made, the raw water test will be repeated to double-check it.
3. If these tests are positive, raw water will be subjected to coagulation and flocculation processes such as alum dosage before being routed through the clarifier tanks for sedimentation. The settled sample is then delivered to the laboratory for testing.
4. The test that did not adhere to the norm will have their raw water alum dose adjusted before going through the coagulation, flocculation, and sedimentation procedure again.
5. Water that meets the specified criteria will be filtered using either a quick or a slow gravity sand filter.
6. The clean water that has previously been filtered will pass via the chemical dosing system, which will include chlorine for disinfection, lime to stabilize the water corrosion characteristic, and pH and fluoride for the development of children's teeth.
7. The water will then flow directly to the Clear Water Tank before being subjected to final measurement or laboratory testing.
8. Water under the desired condition will be sent to the storage tank before passing through the reservoir tanks.
9. Water that did not meet the requirement will have the chemical dosage of clean water changed before going through disinfection, pH stabilization, fluoride addition, and laboratory tests again.
10. The distributed water in reservoir tanks will be maintained by the duty operator's distributor systems.
11. Water from reservoir tanks will be distributed to service areas by the region and at the main office.

CHAPTER 3

OVERVIEW OF THE TRAINING

3.1 Introduction

This chapter describes all the activities that trainees participate in throughout their Industrial Training program at Lembaga Air Perak (LAP). The duration is 24 weeks, beginning on August 22, 2022 and ending on February 3, 2023. Each Industrial Training report made in the reflection logbook is an official record entry used to report duties related to the Industrial Training journey. Furthermore, the drafting of this report considers each duty following systematic and integrated priorities, and the report is fitted to the established agreement so that self-improvement in carrying out tasks and trust may grow alongside.

3.2 Summary of the training and experience gained

These are the only duties and tasks that doing throughout industrial training.

3.2.1 Weekly Activity (summary of each week)

Table 3.2 : Summary of each week during industrial training

Week 1	Briefing with the supervisor
Week 2	Preparing the content for Facebook Live
Week 3	Discussion on the new campaign
Week 4	Organize and pack stuff to move
Week 5	Complete the order from MBP and restock products
Week 6	Design the manufacturing process flow for halal fat soap
Week 7	Discussion for the manufacturing of new beauty products
Week 8	Arrange the laboratory for MARA's visit
Week 9	Determine the expense of the stockist and the agent of Filfilan

Week 10	Handling the visit of OEM founder
Week 11	Calibrate the TDS and conductivity measurements
Week 12	Do physical parameters (pH, color, conductivity, TDS) and chemical parameters (nitrate, fluoride, ammonia, manganese, iron) on water samples
Week 13	Visit Gunung Semanggol and Sungai Rawa Water Treatment Plant
Week 14	Visit Ulu Kinta Water Treatment Plant
Week 15	Attend meeting for ASEAN OSHNET
Week 16	Do physical parameter (pH, color, conductivity, TDS) and chemical parameter (nitrate, fluoride, ammonia, manganese, iron) on water samples took from Kg. Senin
Week 17	Do alkalinity tests
Week 18	Do hardness tests
Week 19	Do physical parameter (pH, color, conductivity, TDS), chemical parameter (nitrate, fluoride, ammonia, manganese, iron, aluminium), hardness tests and alkalinity tests on 9 water samples
Week 20	Visit Sultan Azlan Shah Dam and Sungai Kinta Wastewater Treatment Plant
Week 21	Do physical parameter (pH, color, conductivity, TDS, hardness, alkalinity) and chemical parameter (nitrate, fluoride, ammonia, manganese, iron, chloride, aluminium) on water samples took from Bruas
Week 22	Do physical parameter (pH, color, conductivity, TDS), chemical parameter (nitrate, fluoride, ammonia, manganese, iron, aluminium, chloride), hardness tests and alkalinity tests on raw water samples taken from Parit Buntar's plant
Week 23	Calibrate pH measurements
Week 24	Do the standard working solution on iron, aluminium and ammonia

CHAPTER 4

DETAILS OF EXPERIENCES

4.1 Introduction

I have been assigned as Assistant Science Officer for 13 weeks in Lembaga Air Perak (LAP) and my supervisor has advised me to take part in drinking water monitoring and achievement. The water quality tests for certain parameters are performed at water treatment plants at various stages of the process, such as raw water, settling water, and periodically treated water. Each water treatment facility features laboratories and specialized testing equipment for water quality. Water quality monitoring is also performed regularly throughout the distribution system. Quality monitoring for certain criteria is offered online to verify the quality of safe water production utilized daily things.

The place that I have been located is a laboratory that has received MS ISO IEC 17025:2005 certification recognized through the Malaysian Laboratory Accreditation Scheme (SAMM). The primary objective of this unit is to ensure that the water delivered meets national drinking water quality standards imposed by the Malaysian Ministry of Health. A central laboratory monitors the water quality monitoring, control, and testing performed at each treatment plant laboratory. Aside from the central laboratory, the quality of the test methods must be ensured following the standard operating procedure (SOP) that has been developed.

I have completed some of the tasks allocated to me, including quality control and testing on microbiological content, physical characteristics, non-organic components, organic substances, and heavy metals. I previously accompanied dentists from Parit Dental Clinic, Tapah Dental Clinic, Bagan Datoh Dental Clinic, and Lenggong Dental Clinic to Gunung Semanggol and Sungai Rawa Wastewater Treatment Plant. The objective of the visit is to gain knowledge about the fluoride levels in treated water since it is a vital chemical for strengthening the tooth surface. I learned the difference between dry chemical feed and wet chemical feed during the session to save time, energy, and cost.

Therefore, in an attempt to gain additional real-world experience, I was given the opportunity to attribute at the Ulu Kinta and Sungai Kinta Wastewater Treatment Plant for two weeks. I was tasked with doing water analyses on raw water, clarified water, and treated water from their facility every hour. All of them must test the pH, turbidity, color, and temperature of the water, but treated water also comprises fluoride, free chlorine, full chlorine, odor and taste. The employees and operators were extremely courteous as they taught how to calculate alum, polymer, and lime dosage for jar tests and demonstrated how to shut down the plant, backwash the filter and many more which will be explained in the detail later.

Figure 4.1 : Ulu Kinta Wastewater Treatment Plant

Figure 4.2 : Sungai Kinta Wastewater Treatment Plant

4.2 Details of the Training and Experience Gained

4.2.1 Duties and Tasks Performed

Task 1: Analyse water quality by experimenting with physical and chemical parameter

Water quality refers to the physical, chemical, biological, and aesthetic properties of water that affect its suitability for a range of purposes as well as the health and integrity of aquatic ecosystems. The quality is determined by the local topography and environment, as well as factors such as sewage dispersion and industrial contamination. The water quality parameters are decided by the intended application and will be compared to standards for that type of water. Thus, water provided to the distribution system by the Lembaga Air Perak (LAP) is tested in laboratories to ensure that it meets the Ministry of Health Malaysia's defined criteria (KKM) which the procedure is given. This treated water's quality is monitored by testing on numerous factors, including tests for chemical and microbiological composition, as shown in the table below:

Table 4.2 : Tests for Chemical and Microbiological Composition

Bacterial Test	Total Coliform
	Faecal Coliform
Physical Test	Turbidity
	Color
	pH
Chemical Test	Total dissolved solids
	Alkalinity
	Hardness
	Conductivity
	Chloride
	Ammonia
	Nitrate
	Ferum
	Fluoride
	Aluminium
	Manganese
Heavy Metal Test	Copper

Physical Parameter for Water Treatment

a) Determination of pH

Objective: To determine the pH of water.

Apparatus:

- Orion pH meter
- Orion Triode pH electrode

Reagents:

- pH Buffer 4.01, ORION Cat. No 910104 / HACH Cat. No. 22269-64
- pH Buffer 7.00, ORION Cat. No 910107 / HACH Cat. No. 22270-64
- pH Buffer 10.01, ORION Cat. No 91010

Sample: Deionized water

Procedures:

1. A pH meter is a standardized device that uses recognized pH standard reference values.
2. The electrode is taken from the solution, washed with deionized water, blot dried with a lint-free tissue, and put in the pH buffer.
3. The pH of the test sample is recorded once it has stabilized and has stopped flashing.
4. The electrode is then removed and rinsed with deionized water before another reading is taken.
5. Lastly, the electrode is dipped in pH electrode storage solution after usage.

b) Determination of Colour

Objective: To determine color as it relates to the turbidity of the water.

Apparatus:

- 250 mm path length Nessler tubes
- Lovibond Nessler Attachment
- Lovibond CAA Colour Comparator Disk (0-30 Hazen)
- Lovibond CAB Colour Comparator Disk (35-70 Hazen)
- Lovibond 2000 Comparator

Sample:

- Sample water
- Deionized water

Procedures:

1. The Lovibond color comparator disc (CAA/CAB) is placed to the analyst with its numbered standard, and the Lovibonds 2000 comparator is attached to the slot on top of the Nessler Attachment.
2. The reference tube (left) is filled with deionized water, and the observation tube (right) is loaded with the sample, both to the 250 mm mark.
3. The light is then switched on, and the result is compared to the standard color comparator disc, which is spun till it matches the color of the sample.
4. The color is reported as "apparent color" if the turbidity is still there and hasn't been eliminated otherwise, the color is "true color"
5. The sample's color is recorded as <2.5 HU if it falls between 0 and 2.5 HU and 2.5 HU if the sample color is precisely the same as that of 2.5 HU. If the sample's hue falls within the range of two numerical standards, the range will be recorded.

c) Determination of Conductivity

Objective: To determine conductivity in presence of an ionized substance

Apparatus: HACH Conductivity Meter

Sample: Deionized water

Procedures:

1. The POWER [1] and [COND] buttons on the equipment are pressed. The appropriate equipment is chosen.
2. The probe is placed into the sample solution. To guarantee that no air bubbles are trapped, the probe is swirled vertically while the tip is immersed in or beyond the vent holes.
3. When the reading has stabilized, the result is recorded.
4. Before accomplishing another sample, the probe is properly cleaned with deionized water to avoid contamination and shaken well to remove internal droplets, prior to immersion in the next test sample.

d) Determination of Total Dissolved Solids (TDS)

Objective: To quantify total dissolved solids (TDS), which are inorganic salts and a trace of organic substances that dissolve in water.

Apparatus: TDS meter

Sample:

- Sample water
- Deionized water

Procedures:

1. The POWER [1] and [TDS] buttons on the equipment are pressed. The appropriate equipment is chosen.
2. The probe is placed into the sample solution. To guarantee that no air bubbles are trapped, the probe is swirled vertically while the tip is immersed in or beyond the vent holes.
3. When the reading has stabilized, the result is recorded.
5. Before accomplishing another sample, the probe is properly cleaned with deionized water to avoid contamination and shaken well to remove internal droplets, prior to immersion in the next test sample.

e) Determination of Total Alkalinity by Titration

Objective: To determine the total alkalinity by titration depending on the amount of carbon dioxide present.

Apparatus:

- TitraMate 10 model
- 100 ml of the conical flask
- 50 ml of a pipette
- Digital burette

Reagents:

- Deionized water
- Sulphuric Acid (H_2SO_4) Standard Solution, 0.02N
- Bromocresol Green-Methyl Red Indicator Powder Pillow
- Phenolphthalein Indicator Powder Pillow
- Sodium Thiosulphate, 0.1N

Sample:

- Sample water
- Deionized water

Procedures:

1. A pipette is used to measure the sample volume of 50 ml and then transferred into a 100 ml conical flask where the sample is adjusted to room temperature and a sample size corresponding to the expected alkalinity in mg/l as calcium carbonate, $CaCO_3$ table is selected:

Table 4.4 : Alkalinity Table

Range (mg/l as $CaCO_3$)	Sample volume (ml)	Standard titrant solution concentration (N)
0 – 500	50	0.020
400 – 1000	25	0.020
1000 – 2500	10	0.020

2. If free residual chlorine is present, 1 drop (0.05 ml) of Sodium Thiosulphate Solution, 0.1 N is added to the sample.
3. Phenolphthalein Alkalinity
   i. Digital burette is filled with Standard Acid Solution, 0.02N.
   ii. After adding the contents of one Phenolphthalein Indicator Powder Pillow, the sample is mixed by swirling it.
   iii. If a pink color appears, the sample is titrated by whirling the flask over a white surface until the solution turns colorless from pink.
   iv. The phenolphthalein alkalinity is calculated by:

$$\frac{\frac{mg}{l} Phenolphthalein}{Alkalinity\ as\ CaCO^3} = \frac{ml\ titrant\ used\ \times 0.020N\ \times 50{,}000}{ml\ of\ sample\ volume}$$

   v. If there is no pink color developed, the Phenolphthalein Alkalinity is zero.
4. Total Alkalinity
   i. The content of one Bromocresol Green-Methyl Red Indicator Powder Pillow is also added to the sample and swirled.
   ii. The titration is continued with 0.02N Standard Acid Solution until the endpoint is reached as in **Table 4.5**:

Table 4.5 : Total Alkalinity

Sample trait	pH	Endpoint color
Alkalinity approximately (30mg/l)	5.1	Light green blue-grey
Alkalinity approximately (1500mg/l)	4.8	Light violet grey
Alkalinity approximately (500mg/l)	4.5	Light pink

   iii. The total alkalinity is calculated by:

$$\frac{\frac{mg}{l} Total\ Alkalinity}{Alkalinity\ as\ CaCO_3} = \frac{ml\ titrant\ used\ \times 0.020N\ \times 50{,}000}{ml\ of\ sample\ volume}$$

   iv. The procedure is repeated other 2 times to get the average value and repeated for another sample.

f) Determination of Total Hardness, EDTA Titrimetry

Objective: Using ethylenediaminetetraacetic acid (EDTA) and an appropriate indicator, an aliquot of the sample will be complexometrically titrated to measure the total hardness.

Apparatus:

- TitraMate 10 model
- 100 ml of the conical flask
- 50 ml of the pipette
- Digital burette

Reagents:

- Hardness 1 Buffer Solution
- ManVer 2 Hardness Indicator Powder
- Standard EDTA titrant, 0.02N

Sample: Deionized water

Procedures:

1. A pipette is used to measure 50 ml of the sample and then transferred into the 100 ml of a conical flask, where the sample is adjusted to room temperature and a sample size corresponding to the expected hardness in mg/l as calcium carbonate, $CaCO_3$ table is selected:

Table 4.6 : Hardness Table

Range (mg/l as $CaCO_3$)	Sample volume (ml)	Standard titrant solution concentration (N)
0 – 500	50	0.02
400 – 1000	25	0.02
1000 – 2500	10	0.02

2. 1 ml of Hardness 1 Buffer Solution is added to the sample using a pipette and swirled to mix.
3. The contents of one ManVer 2 Hardness Indicator Powder Pillow is added to the prepared sample and swirled to mix.
4. The digital burette is filled with the Titra Ver Hardness Titrant.

5. The prepared sample is titrated until the color changes from red to blue. Titration is done slowly towards the endpoint to allow time for reaction and color change to take place.
6. Total Hardness calculation is done by:

$$\frac{\frac{mg}{l} Total\ Hardness}{Hardness\ as\ CaCO_3} = \frac{ml\ titrant\ used\ \times 0.020N\ \times 50{,}000}{ml\ of\ sample\ volume}$$

Chemical Parameters for Water Treatment

a) **Determination of Nitrate – Cadmium Reduction Method**

Objective: To determine the presence of nitrate in water.

Apparatus:

- Spectrophotometer
- HACH DR4000
- 25 ml of measuring cylinder
- Stopper
- Sample cell

Reagents:

- NitraVer 6 Nitrate Reagent Powder Pillow
- NitriVer 3 Nitrate Reagent Powder Pillow

Sample: Sample water

Procedures:

1. Using the DR4000 spectrophotometer, the recorded program number for nitrate-nitrogen (NO3-N) is selected by pressing 2515. The wavelength of 507 nm is chosen automatically.
2. A total of 15 mL of sample was placed in a 25 mL measuring cylinder. The NitraVer 6 Reagent Powder Pillow is then added, and the cylinder is vigorously shaken for 3 minutes.
3. The sample is allowed to sit for 2 minutes to ensure the reaction occurs. The sample is then put into the sample cell in a volume of 10 ml.
4. A NitriVer 3 Nitrite Reagent Powder Pillow is introduced in the sample cell and gently shaken for 30 seconds. If nitrate is present, a pink color will appear.
5. After that, wait 15 minutes to ensure that the reaction occurred, and a second sample cell is filled with 10 ml of the original sample as the blank.
6. When the timer beeps, the blank is attached to the cell holder and the [ZERO] button is pressed and 0.00 mg/l NO_3^--N will be obtained. The prepared sample is then immediately placed in the cell holder, and the result is recorded.
7. The procedure is repeated for another sample.

b) Determination of Ammonia – Nessler Method

Objective: To determine the presence of ammonia in water with the Nessler method

Apparatus:

- Spectrophotometer
- HACH DR4000
- 25 ml of measuring cylinder
- Stopper
- sample cell
- 1 ml of a pipette
- 50 ml of a beaker

Reagents:

- HACH Nessler Reagent
- HACH Mineral Stabilizer
- HACH Polyvinyl Alcohol Dispersing Agent

Sample:

- Sample water
- Deionized water

Procedures:

1. Using the HACH DR4000 spectrophotometer, the recorded program number for ammonia-nitrogen (NH_3-N) is selected by pressing 2400. The wavelength of 425 nm is chosen automatically.
2. A measuring cylinder was loaded with 25 ml of sample and another 25 ml of deionized water as a blank.
3. Next, 3 drops of Mineral Stabilizer were added to each measuring cylinder, and the cylinders were inverted several times to mix.
4. 3 drops of Polyvinyl Alcohol Dispersing Agent were also added to each cylinder by holding the dropping bottle vertically and inverting several times to mix.

5. Subsequently, 1.0 ml of Nessler Reagent was pipetted into each cylinder and inverted many times to mix and if ammonia is present, yellow color will appear.
6. The soft key beneath [START TIME] was then pressed, and the minute reaction period began, while each solution was put into the sample cell.
7. When the timer beeps, the blank is attached to the cell holder and the [ZERO] button is pressed and 0.000 mg/l NH_3-N will be obtained. The prepared sample is then immediately placed in the cell holder, and the result is recorded.
8. The procedure is repeated for another sample.

c) Determination of Manganese – PAN Method

Objective: To determine the presence of manganese in water with the PAN method.

Apparatus:

- Spectrophotometer
- HACH DR4000
- Sample cell
- 10 ml of a pipette

Reagents:

- Alkaline Cyanide Reagent Solution
- PAN Indicator Solution
- Ascorbic Acid Powder Pillow

Sample:

- Sample water
- Deionized water

Procedures:

1. Using the HACH DR4000 spectrophotometer, the recorded program number for Manganese (Mn^{2+}) is selected by pressing 2260. The wavelength of 560 nm is chosen automatically.
2. A blank of 10 ml of deionized water is pipetted and placed into a sample cell, followed by a sample of 10 ml pipetted and poured into a sample cell.
3. The Ascorbic Acid Powder Pillow is then put in each cell and swirled to mix. Then, 12 drops of Alkaline-Cyanide Reagent Solution are added to each sample and swirled together to mix it.
4. To each sample, 12 drops of PAN Indicator Solution 0.1% reagent are added and spun to mix. If manganese is present, an orange hue will appear. Allow it to sit for 2 minutes to ensure the reaction occurs.
5. When the timer beeps, the blank is attached to the cell holder and the [ZERO] button is pressed and 0.000 mg/l Mn^{2+} will be obtained. The prepared sample is then immediately placed in the cell holder, and the result is recorded.
6. The procedure is repeated for another sample.

d) Determination of Total Iron – FerroVer Method

Objective: To determine the presence of iron in the water with FerroVer method.

Apparatus:

- Spectrophotometer
- HACH DR4000
- Sample cell
- 10 ml of a pipette
- Beaker

Reagents: Ferrover Iron Reagent Powder Pillow

Sample: Sample water

Procedures:

1. Using the HACH DR4000 spectrophotometer, the recorded program number for Iron (Fe) is selected by pressing 2165. The wavelength of 510 nm is chosen automatically.
2. A pipette was used to transfer 10 ml of the sample into a clean sample cell. The FerroVer Iron Reagent Powder Pillow is then mixed into the prepared sample. If iron is present, an orange color will appear.
3. The soft key beneath [START TIMER] was then pressed, and the 3-minute response period began. Simultaneously, 10 ml of the original sample is pipetted and placed in the sample cell as the blank test.
4. When the timer beeps, the blank is attached to the cell holder and the [ZERO] button is pressed and 0.000 mg/l Fe will be obtained. The prepared sample is then immediately placed in the cell holder, and the result is recorded.
5. The procedure is repeated for another sample.

e) Determination of Fluoride – SPADNS Method

Objective: To determine the presence of fluoride in water with the SPADNS method.

Apparatus:

- Spectrophotometer
- HACH DR4000
- Sample cell
- 10 ml of a pipette
- 2 ml of a pipette

Reagents: SPADNS (Sodium-2-(parasulfophenylazo)-1,8-dihidroxy-3,6-naphthalene disulfonate) Reagent

Sample:

- Sample water
- Deionized water

Procedures:

1. Using the HACH DR4000 spectrophotometer, the recorded program number Fluoride (F^-) is selected by pressing 1900. The wavelength of 580 nm is chosen automatically.
2. 10 ml of sample is pipetted into a sample cell and 10 ml of deionized water is pipetted into a second sample cell as a blank.
3. Then, 2.0 ml of SPADNS Reagent is pipetted into each sample cell and swirled to mix. Allow it 1 minute to give reaction to occur.
4. When the timer beeps, the blank is attached to the cell holder and the [ZERO] button is pressed and 0.00 mg/l F^- will be obtained. The prepared sample is then immediately placed in the cell holder, and the result is recorded.
5. The procedure is repeated for another sample.

f) Determination of Chloride – Mercuric Thiocyanate Method

Objective: To determine the presence of chloride in water with the Mercuric Thiocyanate method.

Apparatus:

- Spectrophotometer
- HACH DR4000
- Sample cell
- 25 ml of a pipette
- 2 ml of a pipette
- 1 ml of a pipette

Reagents:

- Mercuric Thiocyanate Solution
- Ferric Iron Solution

Sample:

- Sample water
- Deionized water

Procedures:

1. Using the HACH DR4000 spectrophotometer, the recorded program number Chloride (Cl^-) is selected by pressing 1400. The wavelength of 455 nm is chosen automatically.
2. 25 ml of sample is pipetted into a sample cell and 25 ml of deionized water is pipetted into a second sample cell as a blank.
3. Then, 2.0 ml of Mercuric Thiocyanate Solution is pipetted into each sample cell and swirled to mix.
4. 1.0 ml of Ferric Iron Solution is pipetted into each sample cell and swirled to mix. Allow it 2 minutes to give reaction to occur.
5. When the timer beeps, the blank is attached to the cell holder and the [ZERO] button is pressed and 0.00 mg/l Cl^- will be obtained. The prepared sample is then immediately placed in the cell holder, and the result is recorded.
6. The procedure is repeated for another sample.

g) Determination of Aluminium – Eriochrome Cyanine R Method

Objective: To determine the presence of aluminium in water with the ECR method.

Apparatus:

- Spectrophotometer
- HACH DR4000
- Sample cell
- 20 ml of a pipette
- 25 ml measuring cylinder

Reagents:

- Eriochrome Cyanine R Reagent Powder Pillow
- Hexamethylenetetramine Buffer Reagent Powder Pillow

Sample: Sample water

Procedures:

1. Using the HACH DR4000 spectrophotometer, the recorded program number Aluminium (Al) is selected by pressing 1010. The wavelength of 522 nm is chosen automatically.
2. A total of 20 mL of sample was placed in a 25 mL measuring cylinder. The ECR Reagent Powder Pillow is then added, and the cylinder is inverted several times to dissolve the powder.
3. The sample is allowed to sit for 30 seconds to ensure the reaction occurs.
4. Hexamethylenetetramine Buffer Reagent Powder Pillow is introduced in the measuring cylinder and gently shaken. If aluminium is present, a red-orange color will appear.
5. 1 drop of ECR was put into a clean sample cell as the blank and being poured with 10 mL from the measuring cylinder. The sample then swirled and the solution start to turn yellow.
6. 10 mL from the remaining solution is filled into the second sample cell.
7. After that, wait 5 minutes to ensure that the reaction occurred, and a second sample cell is filled with 10 ml of the original sample as the blank.

8. When the timer beeps, the blank is attached to the cell holder and the [ZERO] button is pressed and 0.000 mg/l Al^{3+} will be obtained. The prepared sample is then immediately placed in the cell holder, and the result is recorded.
9. The procedure is repeated for another sample.

Task 2: Analytical Quality Control

pH Electrode Calibration

Objective: To adjust the pH meter by measuring solutions of a known pH value.

Apparatus:

- Beaker
- Orion Star A215 pH
- Stirrer

Reagents: pH Buffer Powder Pillows

Sample: Deionized water

Procedures:

1. A beaker is filled with two sets of pH 4 Buffer Powder Pillows and 100 ml of deionized water.
2. The solution is then mixed with the sample by stirring it for 5 minutes.
3. Next, record the temperature and mV that were presented.
4. The procedure is carried out again for pH 7 and pH 10.
5. Following the completion of the three different pH readings, the slope in % is recorded.

Figure 4.3 : pH Solution after Calibration

Task 3: Microbiological Test (Bacteria)

Microbiological Test (Bacteria)

Objective: Quantitatively employing the Membrane filter technique

Apparatus:

1. For sampling
   i. Whirl-Pak with Sodium Thiosulfate tablets
   ii. Icebox (save the sample before taking it to the laboratory)
   iii. Blow torch
2. For filtering
   i. Microfil filter equipment
   ii. 0.45 micrometer HA membrane
   iii. Microfil funnel 100ml
   iv. Ethanol 95% denatured/spirit (to sanitize microfil support fitter)
   v. Membrane forceps
   vi. Absorbent pads
3. For culture
   i. Petri dish contains bacterial media
   - M-Endo Broth for total coliform
   - M-FC for E-Coli
4. For incubation
   i. Dual chamber incubator
5. For sterilization
   i. Hot-Air sterilizing oven
   ii. Autoclave

Procedures:

1. Sampling:
   i) Use a blow torch to sterilize the sample pipe.
   ii) Place the sample water in the small bottle and store it in an ice box.
2. Sample and culture filtering:
   i) Sanitize Microfil Support with spirit
   ii) Position the filter membrane on the microfil support
   iii) Install the microfil funnel on the microfil support and press it down to secure it

iv) Pour 100 ml of sample water into the funnel and filter using a vacuum pump system.

v) Take out the funnel. To lift the membrane paper, press the lever on the microfil support.

vi) Place the filter membrane on the first petri dish (m-Endo) that has been prepared.

vii) Repeat the test for the second petri dish (m-Fc)

3. Incubation:

   i) Place the first petri dish into incubator 1 with a temperature of 35°C (Total coliform)

   ii) Place the second petri dish into incubator 2 with a temperature of 44.5°C (E-coli)

   iii) Incubate for 22 – 24 hours

4. Observation:

   i) Coliforms – showing 'Golden, green sheen' colonies

   ii) Non-coliforms – showing 'red, non-sheen' colonies

   iii) E-coli – blue color colony

   iv) Use the grid system to perform calculations.

4.2.2 Report on Personal Project for Industrial Training

Metropolitan Utilities Corporation (MUC) Sdn. Bhd., a fully owned subsidiary of Intan Utilities Berhad, operates the Ulu Kinta Water Treatment Plant as part of the privatization of the Greater Ipoh Water Supply Scheme II. The State Government of Perak awarded MUC the Built-Operate-Transfer concession under the Greater Ipoh Water Supply Phase II privatization program to supplier, treat, and supply treated water to Lembaga Air Perak (LAP) for distribution to a designated concession area in Perak. MUC and LAP signed a 20-year concession deal in April 1989, which was renewed for another 15 years.

This plant is located 15 kilometers from Ipoh City and 5 kilometers from Tanjung Rambutan. The plant first went into operation in the early 1960s. With a daily treatment capability of 90.9 million liters, or 20 million gallons. In 1990, the treatment capacity was raised to 136 million liters per day or 30 million gallons per day.

The raw water that flows into this treatment plant comes from the Kinta River upstream. The catchment region upstream includes the entirety of Bukit Kinta, which is free of chemical contamination. Clean water that meets Malaysian Water Supply Quality standards is delivered to roughly 300,000 consumers in the region of the facility, including Ipoh Timur, Bercham, Tanjung Rambutan, and Chemor.

The water treatment plant is well-equipped with a Supervisory Control and Data Acquisition (SCADA) System, which offers a comprehensive, real-time data collection and monitoring system for treated water production and distribution. Inspection of the produced water supply is handled in collaboration with the Ministry of Health, the Chemistry Department, and Lembaga Air Perak (LAP).

4.2.2.1 Safety Procedures

This plant's management and administration are particularly concerned about the safety of their personnel. Before we are permitted to enter their facility, we will be handed an instruction card outlining the safety and loss prevention procedures to avoid any problems or tragedies.

When there is an emergency case happen:

1. Vehicles must be parked beside the road to ensure that rescue teams such as BOMBA are not obstructed.
2. Any emergency command must be followed.
3. Proceed to the emergency meeting spot.
4. Remain in the assembling location until the surrounding area is safe.
5. Except for emergency vehicles, do not leave the plant without authorization.

For visitor safety:

1. Every vehicle entering or leaving will be inspected.
2. Smoking is permitted only in designated areas.
3. Obey all safety orders and speed limits.
4. When entering workplaces, wear appropriate footwear.
5. Ear protection must be worn in the particular plant area.
6. To avoid any mishap, do not wear any inappropriate clothing.
7. All visitors must be observed by MUC employees.
8. Without authorization, cameras are not permitted.
9. When an accident occurs, all instances must be immediately reported to a MUC staff.

4.2.2.2 Water Treatment Process

The Ulu Kinta Water Treatment Plant's conventional water treatment procedure is summarized as follows:

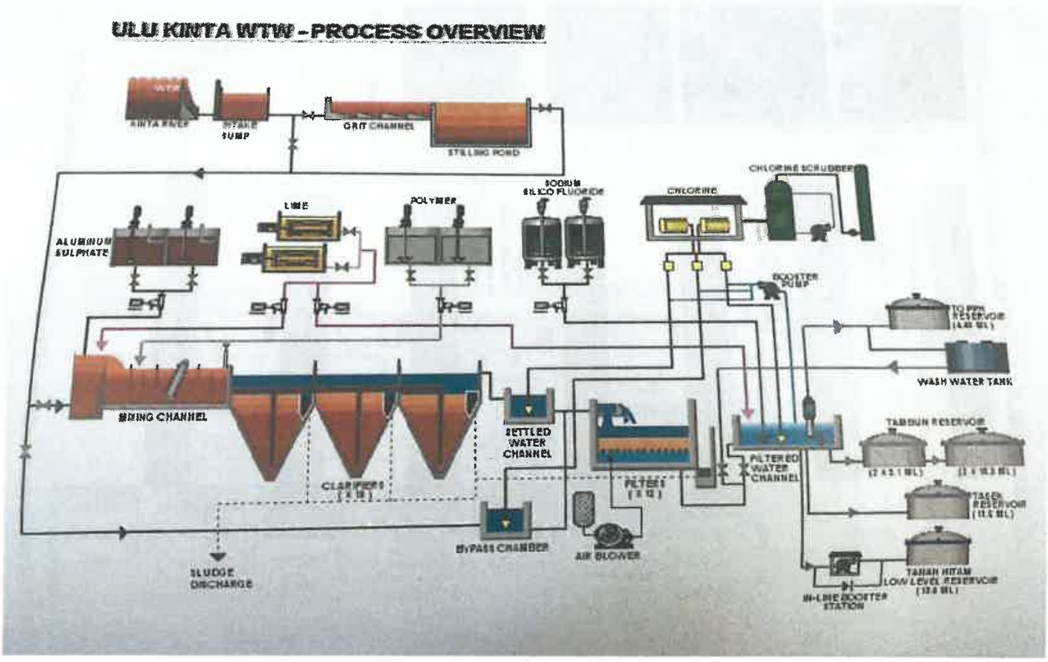
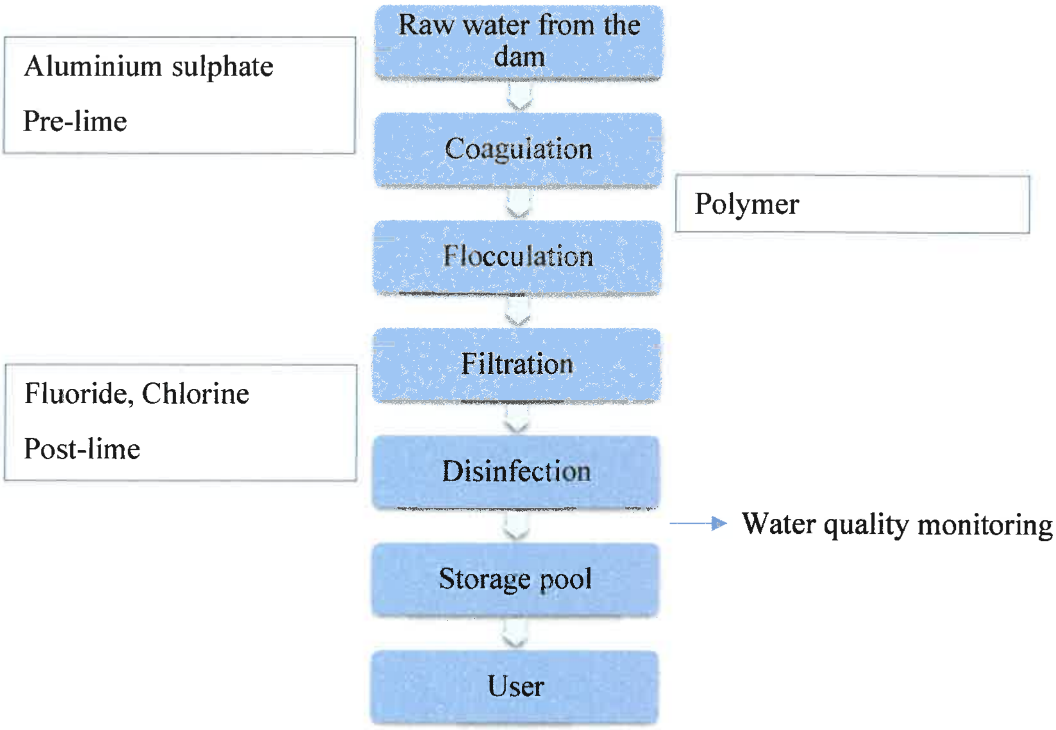


Figure 4.4 : Ulu Kinta Water Treatment Plant

The major processes are as follows:



1. Raw Water Channel (Water Intake)

   Raw water is untreated water found naturally in the environment and can come from many sources, including rivers, lakes, oceans, or groundwater. There are three main structures at Raw Water Channel which are a masonry weir, intake sump and grit channel which have different functions.

   The Kinta River's flow is blocked by the 'Mansory Weir,' which collects the water in a small catchment pond. It is built across an open channel to influence the flow characteristics of the water by behaving as an obstacle to the flow of water.

   Then, the water goes to the intake sump through iron gates to separate the unwanted junk such as wood and leaves. The grit channel will lead water into the pre-sediment pond by gravity. Fine sand will be retained in the grit channel before the water enters the pre-sediment pond. In addition, if indeed the raw water gets excessively hazy, this route is fitted with Poly Dadmac chemical mixing equipment. The chemicals will be mixed by the baffle.

Early pH adjustment, also known as pre-lime, is used to ensure that a sufficient pH level and alkalinity may be maintained, allowing for the best possible coagulation process. The pH and alkalinity of the water affect floc formation and the effectiveness of the coagulation and flocculation processes to remove colloids and suspended particles.

Figure 4.5 : The entrance of raw water from Kinta River

Figure 4.6 : The separation of the unwanted junks

2. Pre-Sediment Pond

   Some of the unwanted junk will fall to the ground before the water descends to the ground by gravity to the water treatment plant. The duration of this process is approximately 45 minutes.

3. Raw Water Pipe

   Water out from the pre-sediment pond is gravity-fed to the treatment plant via a pipe with a diameter of 1067mm that is 42 inches long and 4 kilometers long.

4. Coagulation and Flocculation

The water flowing through the pipe enters the mixing channel. This process starts by taking out all the finer particles in the water by creating pin-sized flocs, aluminium sulfate (alum) and lime injected into the water. This is known as coagulation. Water containing these two chemicals will pass over the baffle, boosting the development of flocs to create visible and settleable particles. For flocculation, polyacrylamide chemicals are introduced into these channels. Flocs expand and settle quickly. The exact dosing amount of every chemical is determined by a jar test conducted before the start of every shift. There are additional grates and screens in this stream to remove leaves and tiny sticks.

5. Clarification

For the clarification process, water combined with the precipitate will flow into the clarifier. This water and sediment flow through penstocks and pipelines into a 30-foot-deep hopper. The water will gently move upwards and overflow at the launders, allowing the solids to settle down to the bottom and leaving a precipitate behind. This precipitation will be suspended and will eventually produce a sludge blanket. This sludge blanket distinguishes between unclean and pure water. A Sludge Concentrator with a programmed valve opening controls this sludge blanket. A 6-inch diameter valve will be used to remove the silt particles at the bottom. The pure water that drains from the tank enters the collecting tube, which flows to the filter.

Figure 4.7 : The sludge blanket that has been produced

6. Filtration

   The clean water that enters is filtered through three layers which are sand, coarse sand, and gravel. To prevent algae development in the filter, clear water from the Clarifier tank will be treated with chemicals, specifically chlorine. The Rapid Sand Filter is affected by water turbidity and time range. Backwashing of filters is performed depending on running phase hours of 72 hours or head loss of filters. When the differential pressure of the filters increases, backwashing is performed regardless of running hours. Backwashing is done by water washing.

7. Clean Water Channel

   The pure water that escapes from the filter is colorless and odorless to create drinkable water, this water will be treated with chemicals such as chlorine to kill the bacteria in the water, lime to stabilize the corrosion qualities of water and fluoride for children. This pure, treated water will be gravity-fed to the user system and distribution ponds in Tambun and Tanah Hitam.

4.2.2.3 Duties and Tasks Performed

Task 1: Laboratory Test

a) **Determination of Free Chlorine – DPD Method**

Objective: To determine the presence of free chlorine in the water.

Apparatus: Spectrophotometer, HACH DR890, sample cell, 10 ml of a pipette

Reagents: DPD Free Chlorine Powder Pillow

Sample: Raw water, settled water, treated water, deionized water

Procedures:

1. Using the HACH DR890 spectrophotometer, the recorded program number Chlorine (Cl_2) is selected.
2. A sample of 10 ml pipetted and poured into a sample cell as a blank.
3. The blank is then attached to the cell holder and the [ZERO] button is pressed and 0.00 mg/l Cl_2 will be obtained.
4. A pipette was used to transfer 10 ml of the sample into a clean sample cell. The DPD Free Chlorine Powder Pillow is then swirled for 20 seconds to mix into the prepared sample. If free chlorine is present, a pink color will appear.
5. The prepared sample is then immediately placed in the cell holder, and the result is recorded.
6. The procedure is repeated for another sample.

b) Determination of Total Chlorine – DPD Method

Objective: To determine the presence of total chlorine in the water.

Apparatus: Spectrophotometer, HACH DR890, sample cell, 10 ml of a pipette

Reagents: DPD Free Chlorine Powder Pillow

Sample: Raw water, settled water, treated water, deionized water

Procedures:

1. Using the HACH DR890 spectrophotometer, the recorded program number Chlorine (Cl_2) is selected.
2. A pipette was used to transfer 10 ml of the sample into a clean sample cell. The DPD Total Chlorine Powder Pillow is then added to the prepared sample and swirled for 20 seconds to mix. If chlorine is present, a pink color will appear.
3. The soft key beneath [START TIMER] was then pressed, and the 3-minute response period began. Simultaneously, 10 ml of the original sample is pipetted and placed in the sample cell as the blank test.
4. When the timer beeps, the blank is attached to the cell holder and the [ZERO] button is pressed and 0.00 mg/l Cl_2 will be obtained. The prepared sample is then immediately placed in the cell holder, and the result is recorded.
5. The procedure is repeated for another sample.

c) Jar Test

Objective: To determine the most effective alum dosage.

Apparatus: Beakers, pipettes,

Reagents:

Sample: Raw water, settled water, treated water, deionized water

Procedures:

1. 6 beakers were filled with 1000 mL of raw water.
2. Each beaker contained a dosage of lime that had been liquefied to 0.1%. The lime dosage should be proportional to the alum dose variance in each sample.
3. Alum dosages were adjusted in each beaker as the table below:

Table 4.7 : Alum Dosages

1 ml alum = 1 ppm	4 ml alum = 4 ppm
2 ml alum = 2 ppm	5 ml alum = 5 ppm
3 ml alum = 3 ppm	6 ml alum = 6 ppm

4. The jar test device was set to a high speed of 200-300 rpm for 1 minute. Then, the polymer chemical was added to each dosage jar with the same dose quantity during the 30th second.
5. After one minute, the tool speed was reduced to 30 - 70 rpm for four minutes.
6. After 4 minutes, the stirrer was turned off and the flocs that have developed was examined. The particles were allowed to settle for up to 20 minutes.
7. After 20 minutes, a water sample from the top of the jar was taken and the turbidity was measured using a turbidity metre.
8. The optimal dose selection is:
    - Time the floc settles down
    - Floc size
    - The type of floc produced
    - Turbidity of settled water
    - The color of the water changes to clear

Task 2: Calculation for Dosing of Chemical Solution

Raw water flow between 2000 m^3/hr – 4000 m^3/hr

ALUM

a) If the tank is empty after washing

   90 bags of alum (50 kg) are charged into 45m^3 of water

   The concentration of the solution is 100,000 ppm (10%)

b) Normal Preparation

   80 bags of alum (50 kg) are charged into 40m^3 of water

   The concentration of the solution is 100,000 ppm (10%)

Calculation of Alum Dosing is as follows:
$$\frac{\textit{Alum Flow}\ (\frac{l}{hr})}{\textit{Raw Water Flow}\ (\frac{m^3}{hr})} \times 10 \times 1000 \quad = \_\_\_\_\_\_\_\_\_\_ \text{ ppm}$$

POLY

3kg of polymer is charged into 7m^3 of water

The concentration of the solution is 429 ppm (0.000429%)

Calculation of Poly Dosing is as follows:
$$\frac{\textit{Poly Flow}\ (\frac{l}{hr})}{\textit{Raw Water Flow}\ (\frac{m^3}{hr})} \times 0.000429 \times 1000 \quad = \_\_\_\_\_\_\_\_\_\_ \text{ ppm}$$

LIME

10 bags (20 kg) are charged into 10m^3

The concentration of the solution is 25000 ppm (0.025%)

Calculation of Pre-Lime Dosing is as follows:
$$\frac{\textit{Pump Stroke}}{100} \times 40617.5 \times \text{Raw Water Total Flow } (\frac{m^3}{hr}) \quad = \_\_\_\_\_\_\_\_\_\_ \text{ ppm}$$

Calculation of Post-Lime Dosing is as follows:	
$\frac{Pump\ Stroke}{100} \times 38500 \times$ Supply Water Total Flow $(\frac{m^3}{hr})$	= ________ ppm

Calculation of Post-Lime (Yellow Pump) Dosing is as follows	
$\frac{Pump\ Stroke}{100} \times 10098 \times$ Supply Water Total Flow $(\frac{m^3}{hr})$	= ________ ppm

FLUORIDE

1 bag (25 kg) of fluoride is charged into 10m^3

The concentration of the solution is 2500 ppm (0.0025%)

Calculation of Fluoride Dosing is as follows:	
$\frac{Fluride\ Flow\ (\frac{l}{hr})}{Supply\ Water\ Flow\ (\frac{m^3}{hr})} \times 0.0025 \times 1000$	= ________ ppm

CHLORINE

Calculation of Chlorine Dosing is as follows:	
$\frac{Supply\ Water\ Flow\ (\frac{m^3}{hr})}{1000} \times 2.5$ ppm	= ________ ppm

Task 3: Learn and Join the Work Process of the Plant's Operator

a) Procedures for Shutdown Water Plant Operations

Objectives:

1. Doing maintenance work at the plant whether planned or not
2. When the water level of the reservoir reaches its maximum level

Procedures:

1. Before the plant shuts down, it's crucial to confirm that all of the reservoir's water levels are at their highest.
2. Turn off the low delivery pump, which is the raw water pump.
3. Turn off the alum and polymer pump.
4. Close the valve on the filter output.
5. Close the disinfection procedure. Shut the drum's valve.
6. Stop utilizing fluoride dosage.
7. Stop injecting lime.
8. Stop each high lift pump individually by the clear water tank's capacity.
9. Wait and adhere to the Plant Supervisor's directions.

b) Filter Washing

Objective: By using clean water and wind to blast away impurities trapped in filter sand.

Procedures:

A) Filter Washing Criteria:

1. The filter has been washed 24 hours ago and has lost more than 1.5 meters of the column.
2. The filter has been operating for 72 hours without being washed.
3. The washing water tank level exceeds 2.0 meters.
4. Other filters are not in the washing process.
5. The filter is in normal condition.

B) Washing:

1. Close Penstock Inlet.
2. Hold off until the water is 0.45 metres deep.
3. Open Penstock Washout.
4. Close the Filter Outlet Valves on the left and right.
5. Switch on the left Air-Scour Valve.
6. Switch on the Air Blower for three minutes.
7. Turn the Air Blower off.
8. Close the left Air-Scour Valve.
9. Turn the Washwater Inlet Valve on the left.
10. For five minutes, clean the filter.
11. Shut off the left Washwater Inlet Valve.
12. Repeat steps 5 through 11 just on the right side.
13. Close Washout Penstock.
14. Open the Penstock Inlet.
15. Wait until the water level reaches the Weir Level.
16. Open the Filter Outlet Valve left and right.

c) Sample Water Flushing for Raw Water and Sludge Water

Objective: To ensure the flow of sample water for Raw Water and Sludge Water reaches the sampling bowl, online equipment and laboratory.

Procedures:

1. Switch off the sampling pump.
2. Turn on the flush valve.
3. Control the valve in the sampling bowl, online, and lab.
4. Until the water is clean, open the auxiliary air valve to flush.
5. Turn off the flush valve.
6. Initiate the sample water pump.
7. Turn off the auxiliary air valve.
8. Regulate the online, laboratory, and sampling bowl flow of the sample water

d) Chlorination of Filtered Water

Objective: This process is called the Disinfection Process; it is a process of adding chlorine chemicals to the water to produce a chemical reaction that will kill microorganisms. A suitable residual free chlorine value is between 1.5 to 3.0 mg/l.

Procedures:

A) Safety measures:

Need to wear the personal protective equipment mentioned below:

1. Gloves
2. Safety hat
3. Safety shoes
4. Gas mask

B) Place 4 chlorine gas drums on Line 1 and four more on Line 2 as stand-by

C) Installation of chlorine drum

1. Take off the drum cover, then tilt the container so the valve is upright. Both the upper and lower valves will release chlorine gas and liquid, respectively.
2. Verify that the drum valve is shut. The upper valve cover nut must be loosened before being manually turned off.
3. Remove the cover nut and use an ammonia bottle to check for leaks. If the drum valve is not tight, leakage may happen. If there is a leak, tighten the valve.
4. Use a dry cloth to make sure the clutch face is clean and dry.
5. Connect the drum to the flexible connector. Every time you make a connection, use a new gasket.
6. Screw the nut in as deeply as possible by hand to avoid improper installation, then tighten it with two spanners to stop the copper flexible from rotating.
7. Open the drum valve for 5 seconds, then shut it again while using a No. 5 spanner. Using a bottle of ammonia, check the safety of the connection at this point.
8. Perform a test on each drum that has been mounted to check for leaks; white smoke will be visible.
9. The chlorine drum is ready to run if there is no leak at the connection.

D) Chlorination Operation:

1. In the chlorinator room
   - i. Open the motive valve and check that the water pressure is greater than 50 psi.
   - ii. Turn the chlorinator's control knob all the way up.
   - iii. Make sure the ball in the flowmeter is at the empty level. If these balls move up and down, this indicates a loose connection in the chlorinator.
   - iv. Inspect the chlorinator for any potential leaks.
   - v. If the ball is at an empty level, turn the control knob to the minimum level.
2. In the chlorine store
   - i. Install the heater on the manifold system
   - ii. Open the chlorine drum valve, auxiliary valve, header valve and manifold valve and check for leaks with an ammonia bottle. If there is white smoke near any connection, it indicates a leak and the drum valve must be closed immediately and the connection must be made again.
   - iii. Make sure the chlorine gas pressure exceeds 1 bar before operating.
3. In the chlorinator room, open the chlorine gas valve and turn the control knob on the chlorinator slowly until getting the desired reading.

Figure 4.8 : Installation of chlorine drum

4.3 Problem Encountered and Approach Adopted for Solving Problems

During the roughly 24 weeks of industrial training, I encountered these typical difficulties and learn how to solve them. I who only interact with other students while in university are not completely aware of the surroundings when exposed to actual job life. If not, I can encounter more daring circumstances when I have the option to complete an internship. There are significant benefits that are largely lacking in universities. In the real work world, problems can be encountered in many ways.

Safety Awareness in Industries

Safety awareness is very vital even whether working in the laboratory or the classroom. Additionally, I engage in industries where the possibility of an accident occurring is very significant. I observed numerous different plant operator work processes during my training at the Ulu Kinta Water Treatment Plant. Although I've gained a lot from all of these activities, there are some drawbacks. The operator may already be accustomed to dealing with the machine's noises and the smell of chemicals like chlorine without any protective gear.

Safety awareness is essential to not just me but also the individuals who work in the sectors. Wearing Personal Protective Equipment (PPE) will reduce human exposure to risks that could result in severe illnesses and workplace injuries. The management provided earplugs to workers to adequately attenuate noise so that their real-world exposure is within recommended range as I and my other internship partner suggested measures to lower the risk of injuries. Since chlorine is a poisonous gas with corrosive qualities, face protection with safety goggles is also required for operators handling chlorine as well as for us.

Accuracy of Measurement

According to its measurement objective, technique, and precision, measuring equipment used as reference objects cover a wide range of products. Nobody conducts experiments by just throwing chemicals into a jar and mixing them. A crucial element of scientific principles is accurate, exact measurement. I frequently obtain an incorrect readout of chemicals solely as a result of the equipment. Most experiments require a pipette, thus it must be acceptable to use. However, there are several instances where the instrument's shortcomings result in unsatisfactory calibration. The pipette's end has been discovered to have some cracks in it, which is where the volume inaccuracy could occur.

This is crucial because subpar equipment, inadequate data processing, or human error might provide results that are far from reality. To guarantee that the pipettes are accurate and dependable for many years to come, I have checked with the lab manager to ensure that they are serviced twice a year. I have also disposed of the broken equipment in the broken glassware bins because they are dangerous and influence measurement accuracy.

4.4 Professional and Ethical Issues

The coordinating principles that a person or a company has created include professionalism and ethics in the workplace. Despite the fact that some individuals may have superior personal standards of ethics, a company often establishes a baseline level of ethics and expectations. Those who don't abide by the ethical policies at work risk disciplinary action, and maybe termination. These regulations at work, like other ethical norms, take everyone's interests into account. This encompasses society, co-workers, employers, and employees.

In the short term, internships count as job experience and provide priceless professional opportunities. The abilities, talents, and experience required to engage in that growth cycle fluctuate along with the everyday changes in our economy. Recent grads may find the employment market to be challenging and competitive. To fulfill demand, internship programs are increasingly becoming a crucial component of the college experience for all students.

Therefore, professionalism should be used even when you're an intern. Due to the large number of people on the placement site who might be future coworkers, employers, or rivals, misbehavior should be prevented. Some of the students are disobedient to the regulations, which raises ethical questions. All company surely have their own rules, the same goes for me. Lembaga Air Perak (LAP) has established several guidelines to guarantee the safety of its staff.

In addition, I'm working in a lab where dangerous chemicals are all over the place. I've talked with my site supervisor about the expectations for the internship site because I'm new to the position, and I pay attention to what the other employees are wearing. In addition, I should maintain good personal hygiene, look tidy and clean, and keep myself well-groomed because these things contribute to a positive first impression and seeming professional. To retain professionalism, it is important to adhere to the dress code norms at this workplace. I will always be reviewed and re-examined by others around me, especially by employers, regardless of how I may feel about it.

The second principle is to treat others with respect if you want to be taken seriously. When it comes to professionalism, attitude mostly pertains to how you come across in interactions with others and how other people see you behaving. To achieve the objectives of the company or organization, a variety of personalities must often engage together in the workplace. Being easy to collaborate with and able to contribute to a group needs having a professional attitude, which is a vital component. As an intern, I must be mindful of my limits and what I don't know, and I must also be careful to avoid making judgments that can make me seem conceited. However, I should exhibit persistence and a desire to try tasks and software I have not used before.

I must adhere to the fixed working hours set by Lembaga Air Perak (LAP). Being on time portrays professionalism and makes one stand out as a dependable and competent worker. Being on time demonstrates my commitment to my work and my appreciation for other people's time as much as I do. Being on time means not only being at work promptly in the morning but also completing the assigned assignment before the deadline. I gain credibility as a reliable and regular intern by being on time. Everything operates smoothly in an interconnected working environment as a well-oiled machine. Being punctual ensures that I am doing all in my ability to preserve discipline.

4.5 Health, Environmental and Sustainable Aspects

Figure 4.9 : The Sustainable Development Goals (SDGs)

The Sustainable Development Goals (SDGs) were unveiled in 2012 during the Rio de Janeiro United Nations Conference on Sustainable Development. The SDGs serve as a road map for building a better and more productive future for everyone. It deals with issues like poverty, injustice, climate change, destruction of the environment, democracy, and tolerance, among other global problems we face today. The 17 goals are all interconnected, therefore it's critical that we complete them all by 2030 to guarantee that nobody falls behind.

One of the countries committed to achieving this objective is Malaysia, which introduced the Green Technology Master Plan (GTMP) in 2017 to carry out the SDG plans. The GTMP is crucial to accomplishing the SDG targets. Lembaga Air Perak (LAP), a water utility corporation, works to achieve the GTMP, which contains the SDG framework's objectives with a major focus on the sixth Goal: Clean Water and Sanitation. Wastewater is a source of water, energy, nutrients, and other by-products that are undervalued, claims the summary "Sustainable Development Goal 6 - Synthesis Report 2018" on water and sanitation.

Lembaga Air Perak helps to facilitate good health and well-being as stated in Goal 3 by providing drinking water solutions and wastewater treatment services, improving sanitation conditions, and also with our laboratory water systems used by worldwide health professionals. The chemical content in water must be tallied with the Ministry of Health recommendations. If the quantity is abnormal, they quickly report and make a solution to ensure the health and safety of the user. We have been given clear explanations of these objectives, and as a collective obligation to the environment, everyone must put forth an effort and work together to achieve them.

The 12th goal, Responsible Consumption and Production, is the final objective that this company uses. The global financial system currently depends greatly on the natural environment and its resources due to global consumption and production. If this keeps up, the earth will suffer negative effects. To properly manage the national environment, Goal 12 encourages LAP to adopt sustainable practices and to incorporate sustainability performance into its reporting cycle. They design technology that promotes sustainable growth. By increasing energy efficiency and offering comprehensive water treatment options, they put their attention on preserving the use of water resources for as long as feasible. This lessens the production processes used by our clients' overall ecological impact and ensures water is used ethically.

LAP will keep implementing SDG principles throughout its daily operations. They are actively striving for methods to improve the beneficial impact of their operations and capabilities. They can accomplish the SDGs and contribute to a green economy for national growth through increasing consumption rates within localities as well as through public-private partnerships.

CHAPTER 5

CONCLUSIONS

5.1 Conclusions

UiTM has always striven to develop well-rounded students, which means the students are not only fitted with conceptual knowledge and technical competence skills, but they are also presumed to have a variety of skills, including leadership qualities, communication abilities, and the capacity for lifelong learning. The creation of a student industrial training program, in my opinion, is a highly effective way to accomplish this goal by exposing students to a genuine working environment.

Upon completing my 24 weeks of industrial training at Lembaga Air Perak, which lasted from 22 August 2022 to 3 February 2022, I can honestly say that I learned a tonne of new, useful skills and techniques from the many tough hands-on assignments that my supervisor undertook. In addition, I learned more about the procedure for treating wastewater. Additionally, my supervisor has given me extensive training in the proper methods and techniques for conducting tests, enabling me to conduct any comparable tests in the future without supervision. The working environment also provided me with a tremendous opportunity for hands-on practice, allowing me to get fresh practical experience for self-improvement, update my understanding of specific techniques, and boost my courage to be more competitive in the future.

In the company, I have experience as a lab assistant where the test quality of sample water either physical or chemical parameters have been done. When compared to the university, where the equipment is limited and we can only see things virtually, this facility has a variety of instruments and equipment that are not available in the lab at the university. My theoretical understanding of water quality as a student may be brought to use rather than being learned simply for exams. It is discovered that the benefits of the practical experiences gained during the internship improve the learning environment. Interacting with a diverse workforce as well as the management team is a part of interpersonal skills. Additionally, multitasking skills were viewed as essential for effective employment.

Additionally, industrial training improved my employability abilities and helped me psychologically and physically prepare for the actual working phase so that I could think through and address any issues that might arise. Working in the real world versus working while in university differs in a significant way. It is fortunate for me to be training here since I am granted an exemption to visit four different plants, including Gunung Semanggol, Sg Rawa, Ulu Kinta, and Sg Kinta Wastewater Treatment Plant, instead of just one. These experiences have given me a new perspective on how real-world work situations operate. In addition to boosting my confidence and proactive attitude during the internship, I also trained my mind to handle criticism.

Finally, working hard to improve my academic performance and gain incredible achievements like these engineer leaders and supervisors whom I have worked with probably serves as inspiration. In an effort to enlighten and counsel on every topic for future use, the employees at Lembaga Air Perak (LAP) and other wastewater treatment plants provide me with a great deal of support and encouragement.

5.2 Suggestions and Recommendations

I've acquired a lot of new, essential skills and approaches throughout my internship through a variety of challenging problems. Industrial training also improved my competency skills and helped me emotionally and physically prepare for the actual working phase so that I could think through and address any concerns that might arise. I want to draw attention to a few areas where the industrial training institute itself needs to improve. One improvement that can be suggested is that the LAP laboratory should have a better system in place for ways to dispose of used chemical reagents. Although these reagents are not extremely hazardous, it is still crucial to handle them carefully because improper handling of chemical wastes might result because of exposure to chemicals, reactions, explosions, or spills.

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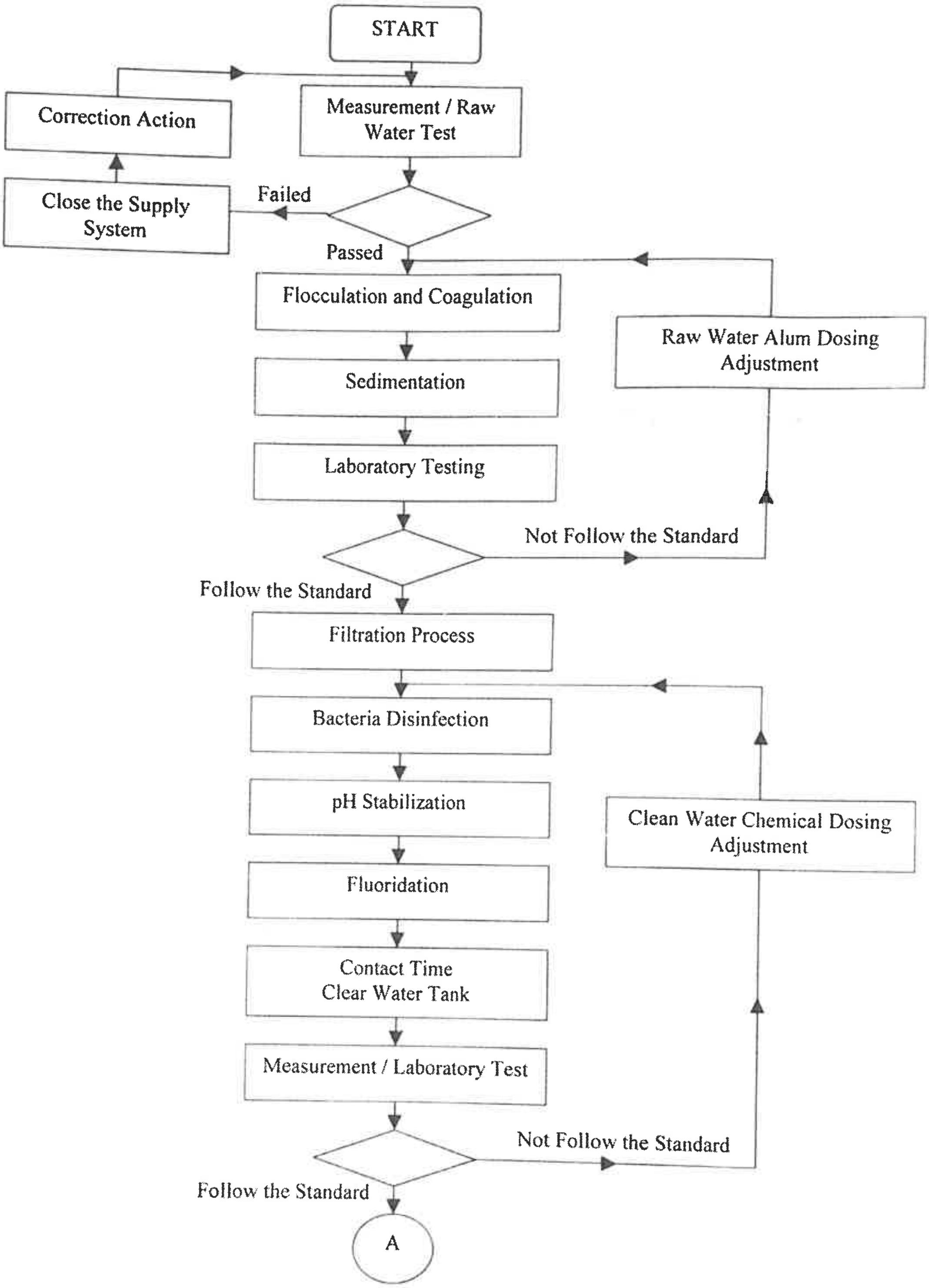
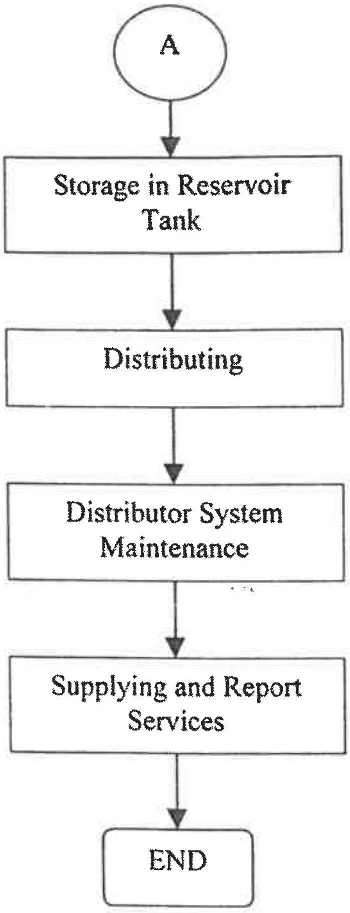
2. Individual
   - Encik Norzaimi bin Harun. (Industrial Training Supervisor)

APPENDIX

Appendix B-PK-(P)-01

WATER TREATMENT PROCESS FLOWCHART

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Distributing
Distributor System Maintenance
Supplying and Report Services
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