INDUSTRIAL TRAINING REPORT (CHE353)

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1.0 INTRODUCTION

1.1 Acknowledge

First and foremost, I want to express my gratitude to Toyota ASSB for providing me with the opportunity to complete my industrial training. The internship opportunity I got with ASSB was a fantastic opportunity for me to learn and grow professionally. I'm also glad for the opportunity to meet so many amazing people and experts who guided me throughout my internship.

I'd want to show my gratitude to all of the ASSB employees who, despite their hectic schedules, freely spent time with me during my training, guiding me, providing project ideas, providing required advice, and encouraging me. My boss also taught me about work ethics, including timeliness and disciplinary procedures.

I'd also like to express my gratitude to all of the engineers, staff, technicians, and trainees at ASSB for their generosity in assisting and supporting me throughout my industrial training programme. I'd also like to express my gratitude to Mr Yoon Kim Katt, the senior manager of ASSB, Environment, safety & Health department, who has continued to guide us and understand our employees' situations during the mco term.

1.2 Introduction of CHE353 Industrial Training

In the engineering curriculum, industrial training is very significant. Theories learned in both core and non-core courses will need to be applied in a real-world setting in the chemical industry. Prior to beginning industry training, students are taught how to fill out job applications in preparation for their first day on the job. They must receive training in a variety of businesses relevant to the course in order to gain as much knowledge as possible about their studies.

As of the course Diploma in Chemical Engineering at UiTM, the mandatory final subject is Industrial Training CHE353. Semester 6 students must complete this industrial training in order to complete their diploma studies. Students must search and apply for an internship at any company that is linked to the chemical engineering sector before entering the real world. They must undergo the internship for at least 17 weeks following the date given by lecturer in charge.

First, define the types of work that chemical engineers conduct in the actual world and comprehend the theoretical knowledge learned are the course outcomes projected for students to be able to complete at the end of the industrial training. Second, capable of performing basic engineering activities such as writing technical reports, talking with co-

workers, managing projects, and producing proposals for industry improvement. Finally, students should be able to do engineering with a better level of integrity, ethics, and accountability.

Based on UITM, some proposed training activities for students are project management, equipment design, production of oleo chemicals, food and beverage, pharmaceutical and biotechnology, familiarization with real PID and PFD as well as other related stimulation works, interpretation and inspection of engineering drawings from relevant consultant companies, equipment stability assessment or troubleshooting and maintenance, laboratory works, production and manufacturing assemblies and site visit for environmental or oil and gas field.

1.3 Company Details

A company that has been chosen for me to undergo an industrial training is TOYOTA assembly Services Sdn Bhd (ASSB) Bukit Raja Plant which is located at Kawasan Perindustrian Bukit Raja, Klang. This is an assembly and manufacturing company. Assembly Services Sdn Bhd (ASSB) functions primarily as the assembler and accessory fitting experts for Toyota vehicles in both the local and international markets. It performs these services in one of the largest and most modern motor assembly plants in Malaysia. Through a team of highly trained specialists, who are passionate about delivering top-quality products to their customers, ASSB assembles up to 100,000 vehicles each year, making it one of the most efficient facilities within the global Toyota network.

Figure 1; Location of ASSB Bukit Raja Plant on Satellite

2.0 Content

2.1 Organization chart

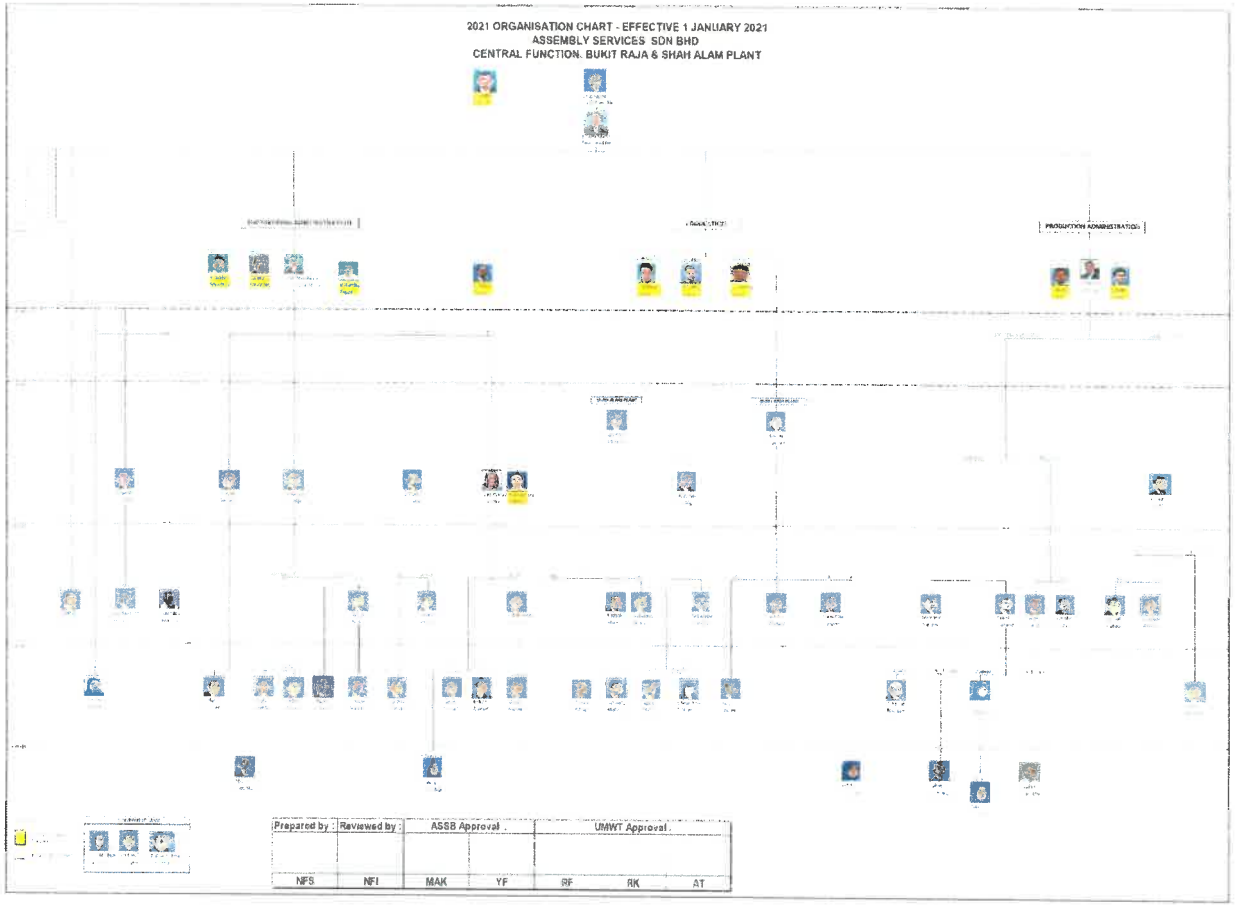

Figure 2; ASSB (Assembly Services Sdn Bhd) 2021's Organization Chart

2.2 History of company

Assembly Services Sdn. Bhd. was founded in 1974 and is wholly owned by UMW Toyota Motor Sdn Bhd. The Company's line of business includes the manufacturing and assembling of complete passenger automobiles. Assembly Services Sdn Bhd assembles Toyota passenger and commercial vehicles in one of the largest and most advanced motor assembly plants in Malaysia.

Local assembly of Toyotas began in 1968 at the Champion Motor plant in Shah Alam. This plant was then renamed Assembly Services Sdn Bhd in 1975. In 1982, UMW formed a joint venture with Toyota. By 1998, Assembly Services was expanded to a capacity of 50,000 units a year. In 2000, a total of 500,000 locally-assembled Toyotas had been produced and by 2011, that number doubled to 1,000,000 units

Assembly Services Sdn Bhd's Shah Alam Plant has started its operation since 1968 through Champion Motor with the first model being the Corolla KE10. In 1975, Champion Motor was renamed to Assembly Services Sdn Bhd (ASSB). In 1982, Sejati Motor, the predecessor to UMWT (the name change happened in 1987) was formed as a JV between UMW, TMC and Toyota Tsusho Corp and acquired the ASSB plant. This plant currently manufactures Toyota Innova, Toyota Hilux, Toyota Fortuner and Toyota Hiace commercial vehicle.

UMW Toyota eventually produced 1,500,000 vehicles, but by 2016 it was clear that a modernised assembly would be required and the plans for the Bukit Raja plant were put in motion. In 2019, ASSB BRP starts it operation. It has an output of 50,000 units a year Bukit Raja plant is considered one of the most advanced car manufacturing plants in the world The plant features a pedestrian promenade throughcut to ensure people and machines cross paths as minimally as possible. Solar Panels and Rainwater Recycling Facilities also present in this plant

	SAP (Shah Alam Plant)	**BRP (Bukit Raja Plant)**
Capacity	38,000 units (no OT & 242 days/year)	50,000 units
Employees	1,125 pax (May '19)	1,052 pax
Operation	2 shifts	2 shifts
Robots	-	45% (61 robots)

Table 2; Difference between SAP and BRP

Table 2 shows the difference aspect of SAP and BRP. Given the larger plant at BRP, it has more capacity and employees than SAP. 45% of workload at BRP are covered by robots while SAP is fully by humans. That's one of the reasons why it has larger capacity than SAP.

Figure 3; Products of SAP and BRP

Figure 3 shows the different car assembled by different plant. At Shah Alam Plant, the cars produced are Toyota Innova, Toyota Hilux, Toyota Fortuner and Toyota Hiace commercial vehicle while at Bukit Raja Plant, it produced Toyota Vios, yaris and he newest one is Corolla Cross. Shah Alam Plant eventually assembled larger cars depending to Bukit Raja Plant.

2.3 Process Flow

In ASSB Bukit Raja, there are production line and main office. Production is where the product is physically been done while main office is a place where all necessary documents are managed. In main office, there are various departments such as account, environment, safety and health, admin support, human resources and production engineering. They are the ones who are responsible for managing all product related documents.

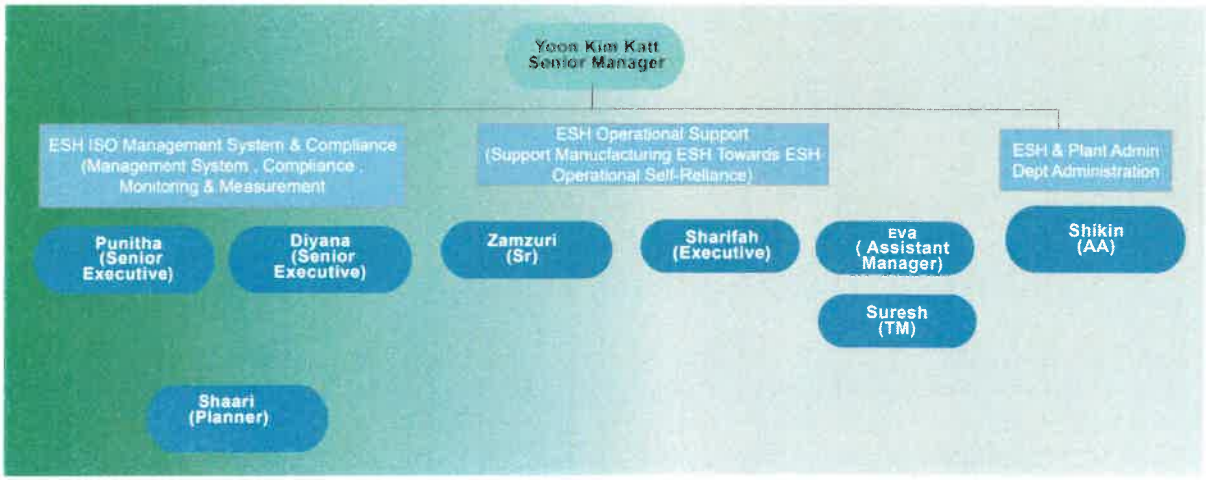

Figure 4; Process Flow for Environment, Safety & Health Department

As of Environment, Safety & Health Department, its process flow is as shown at figure 4. This department is lead by the senior manager, Mr Yoon Kim Katt. He is the one who will monitor his employees and verify every required document. Under Mr Yoon, it is divided into three scopes of work which are ESH ISO Management system & compliance, ESH operational

support and ESH & plant admin department administration. Each employee is divided into these three scopes of work. For ESH ISO Management system & compliance, the person in charge are Ms Punitha and Ms Diyana who's both are senior executive there. They're in charge of the management system, compliance, monitoring & measurement works for environment, safety & health such as CHRA (Chemical Health Risk Assessment). They also will be support by the planner, Mr Shaari. Next, for ESH operational support, it is managed by Mr Zamzuri, Ms Sharifah and Mr Eva, with the help of Mr Suresh. They'll support the manufacturing of ESH towards ESH operational self-reliance such as PTW (permit to work) documents. Lastly, Ms Shikin, the assistant admin, is the one who's in charge of ESH plant admin department administration. She's also the right hand of Mr Yoon.

For production line, it is divided into various departments too which are logistic, QC (Quality Control), welding shop, paint shop, assembly shop, wastewater treatment and maintenance & utilities. These departments are connected to each other in terms of the process flow as shown in figure 5.

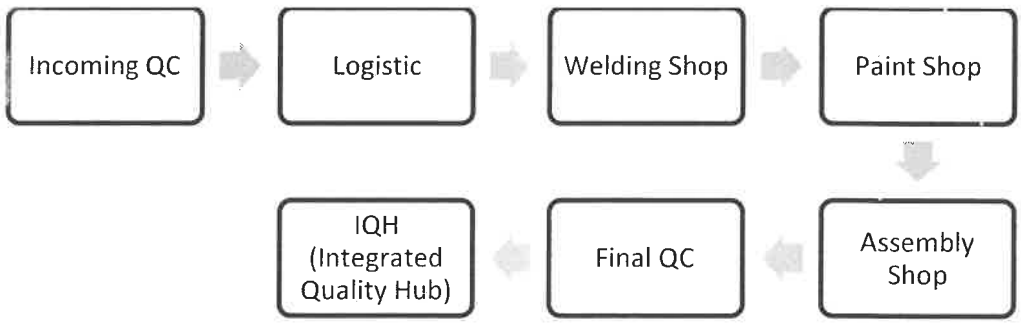

Figure 5; Process Flow of ASSB Production Line

Firstly, there will be incoming quality check and sampling check at logistic area. Then, quality feedback from the ASSB production will be given to suppliers.

For logistic department, firstly, the car parts coming from exporter will be store in an export part. If there's any return module to exporter, it will be put at returnable rack. After that, the export will be received via shipping port and the process name is prime mover process. Then, after shipping port, the export part received will be stored at warehouse. There are two different warehouse which are container yard which is for temporary storage and TLS warehouse. Next, the parts received at receiving area or unloading docks via forklift for unloading process and transfer process. After receiving area, it will go to the parts storage and it will be unpacked after that. Unpacking parts are divided into two which are lot unpacking and small parts unpacking. The unpacking lot will be straight bought to supply lot and then the production line while for small parts unpacking, it needs to store at rack store first manually or

by using tow truck and then going to jundate picking before finally going to the jundate supply. Both jundate supply and lot supply are brought to the next process.

At welding shop, from the logistic area, it will be unboxing first. The unboxing opening the case (handling structure case & part), tightening open bolt case and supply to racking. After unboxing is the SPS where it will pick up and supply part. After that, they will set parts into jig, doing CO2 process and transfer the parts. Lastly will be the inspection and docking process. After done with the welding, it will then move to a paint shop.

At paint shop, the first step is the electrodeposition process for chassis and body. After that, they will apply pvc and sealer for under body carriage. Then, it is an ED sanding process where it will detect a sanding defect from ED. Next is sealer where they will apply sealer to panel to prevent water leak. Then, robot will spray the primer coat and send to wet sanding for primer defect. Then, robots will spray colour and clear and lastly, they will touch up the repair defect from top coat and transfer it to the assembly shop.

At assembly shop, it is divided into three lines which are trim, chassis and final line. At trim line, they will remove door assy from body and transfer to door line. Then, fix internal component of body (engine parts component in engine compartment trim pads/ wire harness/ windshield glass/ headlining/ IP/ rear seat belt/ air con tubing/ rear absorber/rear combi lamp fixing). The, trim assy transfer to chassis line. At chassis line, it will be complete engine assy/ floor piping/ rear beam/exhaust fixing, break oil & air cond gas fixing and chassis assy will transfer to the final line. At final line, it will involve of windshield assy/ carpet battery/ spare tyre/ seat/ bumper/ tyre assy/ door/ and luggage compartment fixing. After that, final assy will transfer to the inspection line, at inspection line, there will be rope test body and the body will go to CS line. Body from CS line will go to the yard storage.

Next is the quality control where form the production line before, it will undergo customer satisfaction line where there is quality inspection for body fitting and the others. Nest is the functional inspection line where there will be some adjustment, installation and inspection of functional aspects. Next step is the QC final rectification area where there are vehicle specification inspection and confirmation after repair. Lastly, after vehicle specification inspection, vehicle will be pickup by car carrier and send to IQH (Integrated Quality Hub).

2.3 Daily/weekly tasks

For my department, there's no specific work need to do daily, as there's no repetitive daily work required but it can be repetitive within week or month. On the first week, there was a HR training with Mr Heirme, a trainer at ASSB SAP. He introduces the company, its history and some nature of this company as shown at figure 6. Then, there is brief talk with department manager too where he assigned supervisor for trainee and explained the scopes of work. There is task need to be done within this week too which the road mapping hazard. The road mapping hazard is where worker need to mapping the track they go and back from work. It is used for company to track the employee if there are any accident happen. This will make worker to be more aware of the road hazards and rules. The next day, need to check on latest SDS (2020) as ordered by supervisor. Then is Genba (plant visit) at production line (assembly shop) and lastly was a safety training at SAP.

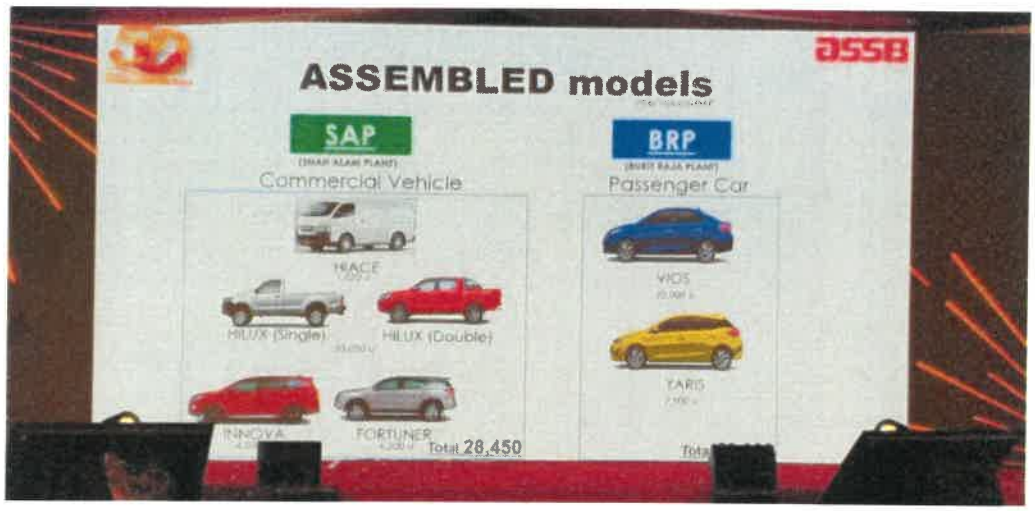

Figure 6; One of The Information Presented during HR Training

During week 2, tsk that has been assigned is to make poster for health campaign as shown in figure 7. This poster was made to raise an awareness about the importance of healthy food. Then, I also need to help on checking attendance for CSHE meeting. CSHE meeting is the monthly meeting for ESH department. Next, I need to assist supervisor on CHRA (Chemical Health Risk Assessment) project at meeting room to get rough idea on CHRA.

Figure 7; Health Campaign Posters

On week 3, I've been assigned to support the document for CHRA in which I need to looking up for the unfound SDS (Safety Data Sheet). SDS is important for every chemical because it has all the information for that particular chemical. Other than that, I need to do correction on health campaign's poster as some information need to be changed. Then, I need to continue supporting CHRA documents in which labelling the SAP layout to be used for the CHRA. Lastly, I need to contribute some ideas on the upcoming campaign's poster, which is hari raya's campaign.

For week 4, it is the hari raya campaign week so the whole will be busy with the campaign itself. This campaign is to raise awareness on the importance of safety on the road. Tokens need to be prepared for the campaign and put up some sales information for the campaign. Next, the tokens need to be distributed to the staffs.

As for week 5, it is the same for week 4, which is this time it is the second week for the campaign. All tasks are repeated as in week 4 but this week was focused on another shift.

Figure 8; Hari Raya's Safety Campaign

During week 6, after the campaign, all of the token's serial number need to be key in to prevent double tokens and exceeding budget. It is also to know the sales during the campaign. Then, during this week also need to proceed on making monthly report to be checked by supervisor and head of department. This report is necessary for every month. Then, need to help on editing Microsoft PowerPoint slides for presentation and monthly CSHE meeting were held too during this week. All of the environment, safety & health issues were presented during this week. This is necessary to know the problems occur and try to find its solution.

As for week 7, chemical register list needs to be updated to give to the assessor. Chemical register list is one of the important documents in doing CHRA. Then, helping on key-in the staff's attendance for CSHE meeting and Plant Engineering (PTE) information. Other than that, task for this week is to help on 'Yarisoi Translate Video' presentation too and lastly, during this week, all of SDS folders need to be classified by referring to Chemical Register master list.

Week 8 is when company' annual leave deduction, replaced public holiday and public holiday days. So, there's no staff present during this week.

For week 9, task given was to support the environment works. Several environment questions need to be transferred to google form for staffs training later on. Some of the questions are about handling toxic waste. More environment's knowledge gotten when doing this task. Then, more CHRA documents need to be done to give to the assessor. All of the SDS folders need to be transferred to zip file to give to the assessor. Then, during this week, the mini project was given by the supervisor. The mini project is hazop study on WWTP.

To know more about WWTP, some researches were done about the wastewater treatment plant. Research on HAZOP was also done to have a better knowledge on the project. During week 10 too, need to help on the solar power poster. This poster consists of environmental initiatives and benefits of solar power usage itself. The site visit to WWTP was also done during this week to experience the real wastewater treatment plant and to have better knowledge to do the mini project later on.

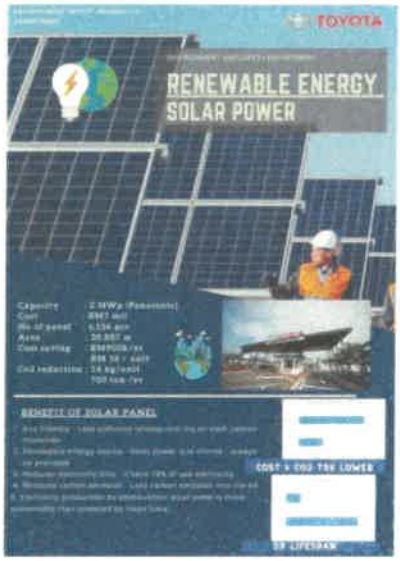

Figure 9; Solar PowerPoster

For week 11, supervisor giving some instructions and recommendations for the mini project. All of the contents need be based on her preferences. To do so, documents got from the plant visit before need to be review thoroughly and sort out all the questions. A list of questions prepared to be asked to the WWTP's person in charge.

During week 12 was when the work from home started. Trainee has been told by manager to not come to the office and continue doing the report. So, the progress of mini project was started during this week. The thorough research of WWTP was done and started sketching on the HAZOP report. Then, during week 13, the task that have been assigned is to help on checking the chemical listing by supplier and chemical checking database. SOC declaration form and certification with TMR need to be checked on. It needs some time to be finished.

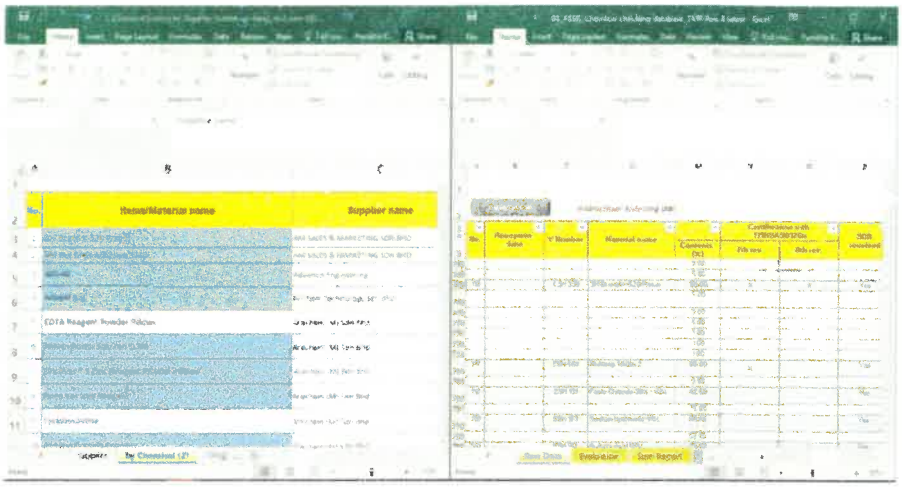

Figure 10; SOC Declaration Form and Certification With TMR

For week 14, continue on doing the progress for mini project which is the hazop. Steps by steps of doing the mini project were prepared to be filled in the methodology part. Methodology part was when the plant visit. So, all of the information and evidence were collected from colleagues.

In week 15 was when the crucial part of the mini project was done which is the hazop table. The hazop table was divided to 5 zones which is zone A, B, C, D and E. All explanations need to be detailed to be filled into the report. Some questions were asked to the WWTP's person in charge too.

Then, for week 16, the mini project needs to be finalized to give to the company itself. Then, supervisor assigned to finalize the industrial training presentation slide for her to check later on.

Lastly, on week 17, the presentation slide and mini project report was being sent to the supervisor to be checked. The last company's monthly report also need to be done for the company's record.

2.4 Mini Project

2.4.1 Introduction

Wastewater treatment is a process used to remove contaminants from wastewater and convert it into an effluent that can be returned to the water cycle. Once returned to the water cycle, the effluent creates an acceptable impact on the environment or is reused for various purposes (called water reclamation). [1] The treatment process takes place in a wastewater treatment plant. There are several kinds of wastewater which are treated at the appropriate type of wastewater treatment plant. For domestic wastewater (also called municipal wastewater or sewage), the treatment plant is called a sewage treatment plant. For industrial wastewater, treatment either takes place in a separate industrial wastewater treatment plant, or in a sewage treatment plant (usually after some form of pre-treatment). Further types of wastewater treatment plants include agricultural wastewater treatment plants and leachate treatment plants. [2]

In Toyota Assembly Services Sdn Bhd, there are two plants operated which are Bukit raja Plant (BRP) and Shah Alam Plant (SAP). These plants provided their own wastewater treatment plant. As for BRP, the treatment system starts with IWM, IWO and IWG treatment system. IWM Treatment System is a system that treat metal substances such as iron and copper while IWO Treatment System is a system that treat oil substances. Then, IWG Treatment System is a system that treat general substances other than the metal and oil substances. After the wastewater had been treated through these three systems, it will undergo Biological Treatment System as the next stage and the final step is the final discharge.

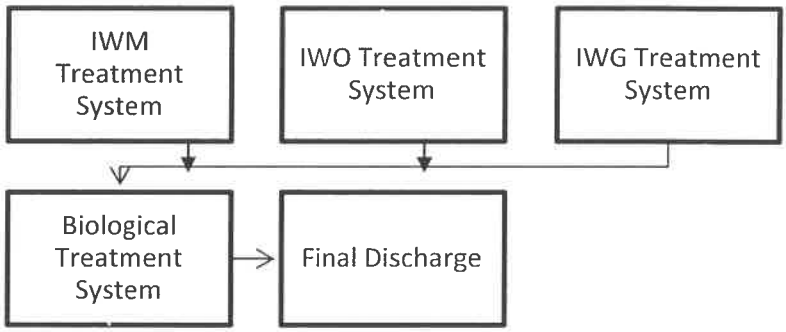

Figure 11; Overall System of WWTP at Bukit Raja Plant

In order to achieve a smooth wastewater treatment system, the system should be clean of any unwanted accidents, and one of the initiatives to prevent these issues is by investing a study called HAZOP study. A hazard and operability study (HAZOP) is a structured and systematic examination of a complex planned or existing process or operation in order to identify and evaluate problems that may represent risks to personnel or equipment. The intention of performing a HAZOP is to review the design to pick up design and engineering issues that may otherwise not have been found. [3]

2.4.2 Methodology

The HAZOP study of a wastewater treatment unit is carried out through a structured analysis of the system and its processes. Firstly, to have a clear image on the whole of wastewater treatment plant used, site visit to wastewater treatment plant itself is needed. The real experience itself is very important because physical experience is much better than just theories. This plant is divided into 5 zones (zone A, zone B, zone C, zone D and zone E) covering various processes in it.

Next, after the site visit, preview all the documents of that wastewater treatment plant such as the layout and the overall systems. By doing so, it can add the knowledge gotten from the site visit before. From this wastewater treatment plant, it can be seen that they were using

a 2d plant layout as their whole plant layout reference as shown in diagram 2. Plant layout is a plan for effective utilization of facilities for the manufacture of products; involving a most efficient and economical arrangement of machines, materials, personnel, storage space and all supporting services, within available floor space. [4] One of the functions of plant layout is to show streamline flow of materials through the plant. So, the layout will be used to do the HAZOP.

After that, when plant visit and documents' preview were done, the next step is to have a small interview with the person in charge of the wastewater treatment plant itself to have more understandings of documents and plant visit before that. For an example, asking on his daily task at the plant to know more about his standard of procedure daily.

Lastly, after plant visit, documents' preview and the interview session, the last step is making the HAZOP itself and the HAZOP report. This report is important to ensure that all information received is store in an orderly form which is the report. Furthermore, the report serves to document all flows when performing this HAZOP. In the HAZOP report, there are contents of introduction to hazop, methodology, results, discussion and conclusion of the report. For the HAZOP part, there will be a table filled with parameter, guide word, deviation, cause and action required. All of this are the important element in doing HAZOP.

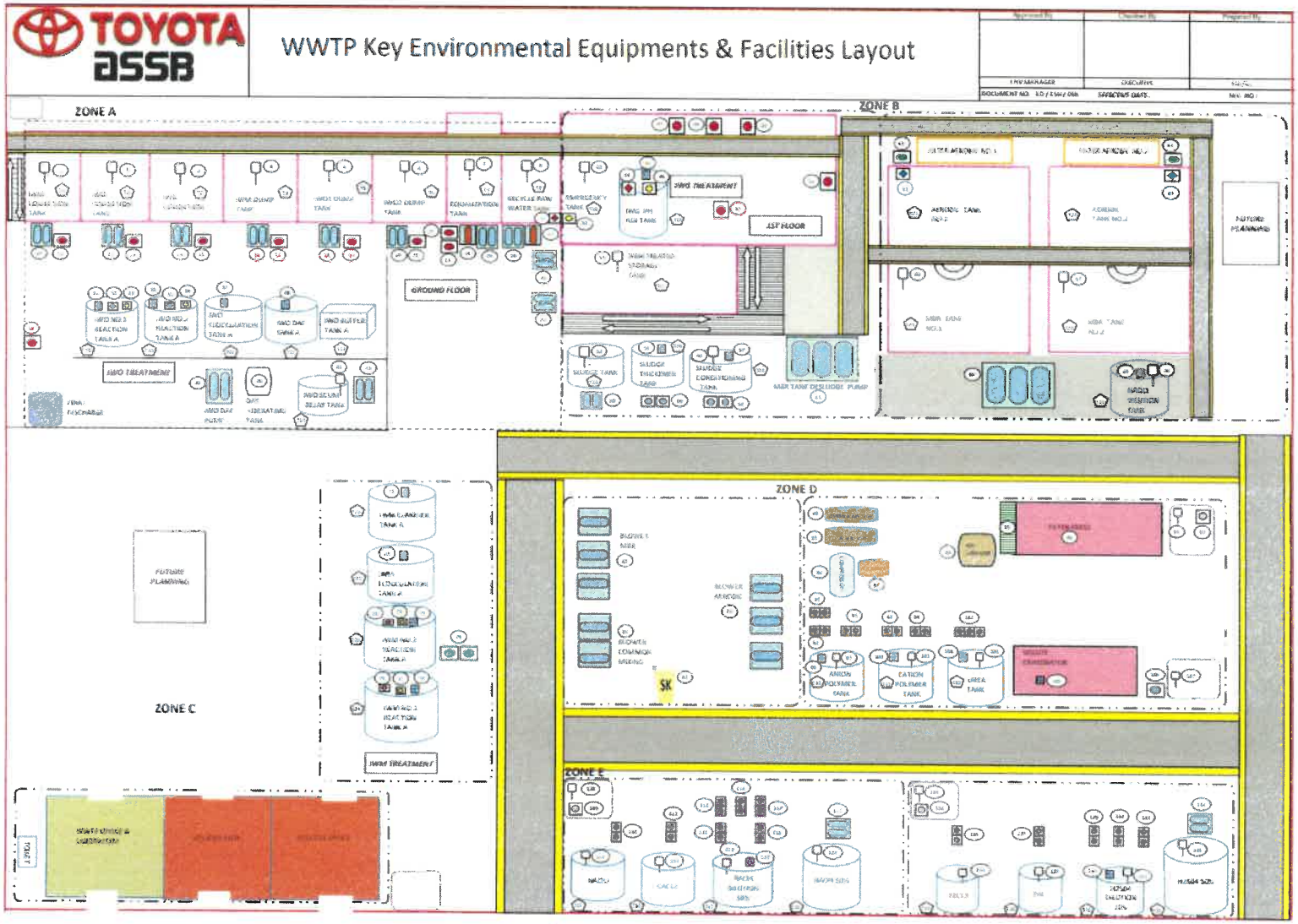

Figure 12; Plant Layout of WWTP of Bukit Raja Plant

2.4.3 Result & Discussion

At wastewater treatment of Bukit Raja Plant, it is divided into 5 zones and involve important processes which are coagulation, flocculation, and sedimentation. [5] Meanwhile, for HAZOP table, it contains parameter, guideword, deviation, cause and action required. Parameter is a measurable factor forming one of a set that defines a system or sets the conditions of its operation such as flow, temperature and pressure. [6] Then guideword is used to define the deviations later on and usually, the guideword is more, less, no, part of, as well as, before and after. Then in the deviation part, it is an elaboration of the parameter and guideword. After that, the causes of that particular problem need to be identified and the expected consequences of it. Consequences is an after effect of the problem. Lastly is the action required part which is the most important part because that is the main objective of doing the hazop which is to have a smooth system with minimal problems.

Zone A

Parameter /Element	Guideword	Deviation	Cause	Consequences	Action required
Safety features of stairs	Less	Less sight during the night	Do not enough lighting on the stairs area	Falling down from the stairs	Putting on neon paints at every stair
Safety features on danger area	Less	Less sensitive to danger area	No signage used	Mixing of chemicals and limited prediction on upcoming accidents	Putting on signage at every important area
Safety of high areas	Other than	Other than signage, it needs more safety features	No proper protection for a high place area	Falling from higher place	Using handrail on every high area

For zone A, there are lots of tank and most of the tank located at a higher place in which a worker needs to use stairs to reach the tank area. They can't avoid the stairs even if it is during the night shift. So, the safety features of the stairs need to be taken care of especially during the night because of limited sources of light. Even with the help of spotlight, the stairs area can cause accidents due to limited lighting there. To avoid any accident at the stairs area, neon paint needs to be used in every corner of the stairs. Neon paint such as neon green can be seen clearly during the night. This can help worker to use the stairs safer at night. Next, accidents that can be predicted is caused by the safety features on danger area. If it has less safety features such as signage, the consequences will be a limited prediction on

upcoming accidents and there may be a mixing of chemicals occur. As an example, if there is no 'do not enter' signage on hazardous area, the worker will be very likely to be exposed to a huge danger such as skin inflammation and the others. Lastly, for a high place area at zone A, other than signage only, it needs more protection to avoid accidents by falling from a high place. Falling from a high place can cause a serious bleeding, broken bones and the worst is it also can be led to dead. To prevent this thing from happen, handrail need to be built in every high place area. This can decrease the chance of a worker to fall.

Zone B

Parameter /Element	Guideword	Deviation	Cause	Consequences	Action required
Water level of MBR tank	Less	Low water level	Pump malfunction	Delay the operations	- Always check the level indicator - Make sure the water level should always 50mm above the membrane module - Turn MBR into low loading mode
Filtration reaction	None	No reaction	Filtration process occur without aeration process	Rapid membrane fouling	Make sure the aeration process is fully complete
Aeration reaction	Less	Less reaction occurs	Aeration process runs without filtration process	- Shorten the life span - Will break the MBR tank	Make sure the filtration process runs alongside with the aeration process
Filtration pressure	More	More pressure	Pressure over 20kPa	Rapid Increase in flow rate of the filtration	Do not conduct filtration if the filtration pressure is over 20kPa
Safety feature on high area (monkey ladder)	Part of	Part of important safety	No suitable protection device used	High fall	Use a proper protection device such as body harness

For zone B, the water level of MBR tank need to be monitor because if its low, it can delay the operations after that because the water level need to be 50mm above the membrane module to make it has a smooth process. Action required when the water level is low are

change it into a low loading mode to prevent further damage to the tank. In low loading mode, pump operation will be off and blower operation will be on for a while and then close for a bit longer. Other than that, level indicator needs to be monitor regularly to prevent the low water level. Next, filtration process cannot occur if there is no aeration process. This can cause a rapid membrane fouling because of the error in the process. So, aeration process needs to be fully complete to continue the filtration process. After that, a bit similar with the first one, but in this case, it will be less reaction occur in aeration process because it runs without filtration process. When this happens, it will shorten the life span of membrane and break down the MBR tank. So, to prevent this incident, filtration process needs to be run alongside with the aeration process. Next, if the filtration pressure exceeds the limit of 20kPa, it can cause an overpressure of filtration process and resulting in rapid increase of the flow rate of the filtration process. So, the process needs to be stop immediately if the pressure exceeds the limit to prevent further accidents from occur. Lastly are the safety features of monkey ladder at this zone. Since it is more than 2 meters, if there is no suitable PPE, it can cause a high that may lead to serious injuries. So. Body harness is needed when working at this place.

Zone C

Parameter /Element	Guideword	Deviation	Cause	Consequences	Action required
Puddles of water on the ground	More	More slippery ground	Uneven ground and heavy rain	- Delay the workers working hour - being slipped	- Ground improvement to be more even - Build rooftop
Laboratory elements in office	Before	Before handling the laboratory	Not wearing gloves	Hand injuries	- Wear gloves - follow company's SOP

At this zone, the expected situation that can cause problems are the puddles of water on the ground at this zone. There are lots of water puddles that actually make the ground slippery. The workers there cannot avoid this area since this is the main and only way to go to zone A and D daily. This situation is very dangerous because it can cause the workers to slip and eventually delay the operation since they need to be extra careful when using this path. The puddles occur because of an uneven ground and heavy rain that make the water to gather in the puddles. Action required to prevent the accidents are by doing the renovation of the ground to make it more even or by building a rooftop to prevent the rain to directly falls on that ground. Other than that, the element that can cause accidents if its not prevent is the laboratory aspects in the office. Before handling the laboratory, workers must wear a suitable the to

prevent a direct contact injury. The suitable PPE can be lab coat, safety gloves, goggles and the others.

Zone D

Parameter / Element	Guideword	Deviation	Cause	Consequences	Action required
Safety features on danger area	Less	Less sensitive to danger area	No signage used	Mixing of chemicals and limited prediction on upcoming accidents	Putting on signage at every important area
Safety of high area	Other than	Other than signage, it needs more safety features	No proper protection for a high place area	Falling from higher place	Using handrail on every high area
Ventilation system	Less	Less air	Locates in a closed area	Breathing difficulty	Use proper ventilation system

For zone D, similarly to zone A, safety features on danger and high space area need to be taken care of to prevent any unwanted accidents to occur. To make sure workers are alert of danger, signage needs to be put up and handrail need to be used to prevent falling from a high place. Meanwhile, for ventilation system in this zone, this zone can cause a breathing difficulty since there are less air because it located in a closed area. For this thing to not be happen, a proper ventilation system needs to be used or the door need to be open sometimes to make sure enough air entering the room when the worker is working.

Zone E

Parameter / Element	Guideword	Deviation	Cause	Consequences	Action required
Flow of Chemical solution (PAC)	Less	Less flow	Clogged silt	Delay the operations	- Scheduled cleaning maintenance - Add sodium hypophosphite to lessen the silt
Impurities of chemical solutions (NaOCl, CaCl2,	Other than	Other chemical solutions mixed	- Miscommu-nication between suppliers and workers	- Mixed of solutions - Delayed of operations	- Suppliers and workers need to be at the tanks where the

NaOH, FeCl3, H2SO4)			- Unlabeled / mislabeled tank	- Piping will be clogged and flow slowly	chemicals will be top up
Flow of chemical solutions (NaOCl, CaCl2, NaOH, FeCl3, H2SO4, PAC)	Other than	More flow of chemical solutions	- Unprotected hands/skin	- Short term / long term effect to health	Use full PPE when handling the chemicals

Lastly, for this zone which is zone E, the parameter that is predicted to cause an unwanted accident is the flow of chemical solution (PAC). When there is less flow on this solution, it may be because of a clogged silt since this solution is easily clump if it doesn't be taken care. It can actually delay the operations a lot since they need to remove the clogged silt first. To prevent this incident from occur, proper cleaning of the machine needs to be scheduled regularly and sodium hypophosphite need to be added to help lessens the silt. The reaction between PAC and sodium hypophosphite can make the molecules to be moving away from each other and do not clump. Then, the impurities of chemical solutions at this zone can cause an unwanted accident to the process. This is because of the mixing of chemical solution caused by miscommunication between suppliers and workers during the preparation time. This can happen when the supplier did not familiar with equipment there because of no instructions or label and no help by the workers on the site. Action required for this incident is suppliers and workers need to be at the tanks together during the process and make sure that it fills to the correct one to prevent any unwanted mixture of chemicals. Lastly is the flow of chemical solutions involved. If handling the chemical solution with no protection, it can cause an irritation to the skin and other problems too. So, workers need to use full PPE when handling the chemicals to avoid a direct contact of that chemical to the body. The suitable PPE can be safety boots, safety gloves and bump cap.

2.4.4 CONCLUSION

A HAZOP analysis presents some operational recommendation to avoid economic and safety loss in the experimental works. However, besides the consideration of economic order, aspects concerning the safety of a process are becoming more important by an increasing knowledge of the environmental problems and life. Safety assessment at workplaces involves operation risks as well as all other kinds of tasks and hazardous activities, resulting in recommendations that will easily be implemented. Although this particular HAZOP attends a Wastewater Treatment Unit, this study can be performed for any industrial plant, in any phase

of this life cycle: project, construction, operation, and others. However, as evidenced, if HAZOP is performed in the project or construction phases, the safety recommendations can be implemented.

2.4.5 Reference

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3.0 Conclusion

As a conclusion, all the course outcome of this subject are achieved successfully which are first, define the types of work that chemical engineers conduct in the actual world and comprehend the theoretical knowledge learned are the course outcomes projected for students to be able to complete at the end of the industrial training. Second, capable of performing basic engineering activities such as writing technical reports, talking with co-workers, managing projects, and producing proposals for industry improvement. Finally, students should be able to do engineering with a better level of integrity, ethics, and accountability.

This industrial training was a once-in-a-lifetime opportunity for me, as I learned a great deal about business and the TOYOTA ASSB Products while walking through the business tunnels. The environment, safety & health department has given me a terrific opportunity to learn about more about machines and workers safety along with the environment aspects. Despite their busy schedules, I am grateful to be surrounded by such nice people at this organisation and for the fresh information they have provided with me. I'm also honoured to have been granted the opportunity to work on a mini project for a company's WWTP HAZOP.

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