ASSESSMENT OF PERMIT-TO-WORK (PTW) SYSTEM IN A PIPELINE OPERATOR COMPANY

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ABSTRACT

Permit-to-work (PTW) is an essential part of safe system of work where it control the risk and hazard of work activities to prevent incident from happening during particular task. Non-compliance in PTW reflect negligence of operators on safety management during work and also lack of operator safety supervision on contractor during work. For this purpose, PTW system audit has been conducted to identify compliance of the permit to work, concurrently with a survey by using a set of questionnaire to evaluate the awareness level of staffs. The study revealed respectively similar trend of PTW compliance in 2015 and 2016 which is 86.33% and 87.83%. However, it declined to 81% in 2017. In the minute scale, Hand back section was found to be critical non-compliance in the range of 8% and 27% throughout three years. Survey results shows average of 86% of respondents are understand the procedures and requirement in PTW. In the part of hot work and gas testing requirement, only 17% to 20% of respondents know the requirement of hot work permit. In the implementation of current PTW system, 63% respondents are not sure that the system is able to prevent hazard on the site effectively and 50% said they are not sure the current system is easy to use. Based on the results obtained, it showed that the potential factors of non-compliance of PTW occurred due to human behavior, system design and management commitment.

ABSTRAK

Permit kerja adalah bahagian penting dalam sistem kerja yang selamat di mana ia mengawal risiko dan bahaya aktiviti kerja untuk mengelakkan insiden berlaku semasa tugas tertentu. Ketidakpatuhan dalam PTW menggambarkan kecuaian pengendali mengenai pengurusan keselamatan semasa kerja dan juga kurang pengawasan keselamatan pengendali pada kontraktor semasa kerja. Untuk tujuan ini, audit sistem PTW telah dijalankan untuk mengenalpasti pematuhan permit untuk bekerja, bersamaan dengan satu tinjauan dengan menggunakan satu set soal selidik untuk menilai tahap kesedaran kakitangan. Kajian menunjukkan trend pematuhan PTW yang sama pada tahun 2015 dan 2016 iaitu 86.33% dan 87.83%. Walau bagaimanapun, ia menurun kepada 81% pada 2017. Dalam skala kecil, bahagian pemulangan dan penutupan permit didapati tidak mematuhi secara kritikal dalam lingkungan 8% dan 27% pematuhan sepanjang tiga tahun. Hasil kajian menunjukkan purata 86% responden memahami prosedur dan keperluan di PTW. Bahagian Kerja panas dan keperluan ujian gas hanya mencapai 17% hingga 20% dimana mereka mengetahui keperluan apabila permit kerja panas dikeluarkan. Dalam pelaksanaan sistem PTW semasa, 63% responden tidak pasti sistem dapat mencegah bahaya di tempat pelaksanaan secara efektif dan 50% mengatakan mereka tidak pasti sistem semasa adalah mudah digunakan. Berdasarkan hasil yang diperoleh, terbukti bahwa faktor potensial ketidakpatuhan PTW terjadi akibat tingkah laku manusia, cara sistem direka dan komitmen pengurusan kerja.

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My appreciation goes to Engineer Executive in the selected pipeline operator company for assisting and providing useful data and information regarding permit-to-work application in the company which ease the completion of this project. Special thanks also to the employees of the pipeline operator company for taking their times to answer the questionnaire.

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LIST OF SYMBOLS AND ABBREVIATIONS

AA	:	Approving Authority
DOSH	:	Department of Safety and Health
E-PTW	:	Electronic Permit-to-Work
JHA	:	Job Hazard Analysis
OSHA	:	Occupational Safety and Health Act
PTW	:	Permit-To-Work
PPE	:	Personal Protective Equipment
RA	:	Reviewing Authority

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CHAPTER 1

INTRODUCTION

1.1 Background of study

As early as 1874, transmission and distribution of natural gas from wellheads and processing plant to the city gate stations or industrial end users are occurred through a vast network of high pressure pipelines (U.S Environmental Protection Agency, 2017). However, the transport of natural gas did not develop as rapidly as refined petroleum due to difficulty of long distance transportation as well as it was not technologically possible. This situation occurred until 1925 before the expansion of natural gas transmission pipeline system build, in which, it now able to transport nearly all of the nation's natural gas (Transportation Research Board, 2004).

Due to the features of the long distance gas pipelines such as high energy and pressure, flammable, toxic and hazardous characteristics, the pipelines are likely exposed to the rupture accidents because of corrosion, material defects, operational errors, or other reasons (Jamshidi et al., 2013). Thus, it is vital to implement safe systems of work in the management to prevent such incidents.

Permit to Work (PTW) system is defined as a formal written process to control work that are potentially hazardous. This also contributes as part of the communication between management, plant supervisor and operators as well as those who carry out the hazardous work (Health Safety Executive, 2005). PTW system is documented either manually or electronically in which authorize certain people to carry out specific work at a specific site at a certain time, whereby main precautions are set out in order to complete the particular job safely.

Although PTW can be helpful in the proper management of a wide range activities, the function of the system in controlling the risk and hazard of a work activities could be done if only the users comply with all the requirements. Often it is found that the PTW set of rules and requirements are not complied, hence dismiss the aim and objectives as a control system to prevent incident from occurring during particular job.

The study will be focusing at pipeline operator company located at the Northern region states of Peninsular Malaysia. This company has implemented permit-to-work system throughout their activities. The work task consists of non-critical work such as grass cutting, housekeeping and pest control as well as critical work such as piling, welding and pigging. Thus, the nature of work at this company is an ideal location to conduct study on permit to work system.

1.2 Problem Statement

Permit-to-Work (PTW) system is a formal safety control document designed to prevent injury to employees, contractors and third parties as well as to property and environment, particularly when work with foreseeable high hazard content is undertaken. The Permit sets out the work to be done, precautions to be taken and the responsibilities of individuals. PTW in the selected company is intended to assist project managers, site engineer, work leader and people in charge of divisional units to ensure that a safe system of work is in place for maintenance work, small or short term projects where previously hazardous conditions have been identified.

A permit to work system will be required to ensure no worker is subjected to any significant risk, and also in fulfilling legal obligations under Occupational Safety and Health Act (OSHA). A permit to work system forms an essential part of a safe system of work. It also forms an integral part of a risk assessment process, where specific hazards

are identified, and suitable control measures are implemented prior to commencement of the work task. Along with that, it is important to ensure that the permit to work system and all its requirement is 100% in compliance in order to be an effective hazard control mechanism.

Based on previous study, non-compliance in PTW could reflect negligence of operators on safety management during work and also lack of operator safety supervision on contractor during work. Therefore, in this study, PTW system audit will take place to identify compliance of the permit to work, concurrently with a survey by using a set of questionnaire to evaluate the awareness level of staffs. With the information, it helps to seek either the system or the people should have further improvements.

1.3 Aim , Purpose and Objectives of Study

The aim of this study is to determine the compliance of permit-to-work system at the pipeline operator company with the purpose of achieving safe execution of work on-site. In realizing this aim and purpose, the following objectives are defined:

i. To conduct an audit on permit to work at selected company by using PTW Technical Standard from selected pipeline operator company
ii. To examine the awareness level of employees by using a set of questionnaires
iii. To identify and propose improvement towards permit to work system

1.4 Scope & Limitation of study

This study was conducted at the pipeline operator station that requires the implementation of permit-to-work (PTW) in their operation and maintenance works. These include hot work, cold work and confine space entry activities. The stations are located at Northern region states of Peninsular Malaysia. A total of 30 employees from

this pipeline operator company are participated in questionnaire to identify the level of awareness on permit-to-work system.

Even though the study has achieved the aim, there are some limitation in this study. It was found that there are only limited previous researches conducted regarding permit-to-work application and system, therefore, it limit the critical literature review on permit-to-work.

1.5 Report Outline

The report layout of this study has been established as below:

Chapter 1 is the introduction of the report. It consists of the background of the study, problem statement, aim, objectives and scope of study.

Chapter 2 is the literature review include overview of permit-to-work (PTW) system, elements in PTW system, type of permit, incidents due to deficiency of permit-to-work (PTW) system and finally possible factors of non-compliance in PTW system.

Chapter 3 consists of methodology that has been adopted to conduct this project. Several methods that have been identified and used in this study are.

Chapter 4 is result and discussion which presents and discusses the analysis conducted. This chapter included the compliance of permit-to-work (PTW) within three years as well as analysis of awareness level of respondents toward PTW practices and ease of system.

Finally, Chapter 5 concludes the report and provide recommendation and improvement for further studies.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter is an overview of literature related to research problem presented in Chapter 1. This part will provides clear view on the proposed research objectives as pointed in previous chapter by viewing the articles, standards and past studies on relation between permit-to-work (PTW) system, related activities using PTW, factors contributing to PTW non-compliance as well as electronic permit-to-work (PTW) system.

2.2 Overview of Permit-To-Work (PTW) System

As stated in Occupational Safety and Health Act and Regulation (OSHA) 1994, it places the duties on every employer and every self-employed person to ensure the safety, health and welfare at work of all his employees as far as is practicable. Notwithstanding this, employers are responsible to provide and maintain a safe system of work and without risk to health (Part IV General Duties of Employers and Self-Employed Person).

Safe system of work or generally known as Permit to Work (PTW) system is introduced as a formal recorded process to control selected work activities which is identified as potentially hazardous to ensure safe execution onsite. It also delivers as part of a communication between site or management, supervisors and operators as well as those who involved with the hazardous work.

According to Guidelines on permit-to-work (PTW) system for OPEC cluster (2015), any work that may adversely affect the safety of personnel, plant or the environment should consider PTW in the process.

Generally, it applies to non-routine work activities. In addition to PTW, identification on precaution to be taken, trainings and others are to be identified in the risk assessments before carry out any work activity.

Health Safety Executive (2005) mentioned that the essential features in PTW system include:

a) Type of work is identified clearly
b) Roles and responsibilities of personnel is stated clearly in the PTW process
c) Training and clear instruction required to all roles
d) Designated work authorized properly based on work nature and area
e) Precautions for a job activity is specified clearly
f) Site surveillance and supervision of work activities are carried out as intended
g) Risk assessments and implementation of risk control measures are conducted
h) Complete documentation including procedures, roles, training and arrangement for work activities that may interact with one another

Based on above features, PTW will be more effective if communication between both management and personnel consulted in order to reflect the needs of the personnel, plant and environment.

In oil and gas industry, PTW is normally applicable when the work activity need to be performed as well as hazard must be controlled or eliminated. The list of activities that are considered appropriate to establish PTW system are as following:

- Non-production work such as maintenance, repair, inspection, testing, alteration, construction, dismantling, adaptation, modification, cleaning and etc
- Non- routine operations

- Jobs where two or more individuals or groups need to coordinate activities to complete the job safely
- Jobs where there is a transfer of work and responsibilities from one group to another

Specifically, hot work, cold work and confined space entry are common work activities that require permit before deliver the task safely at specific location and time.

2.3 Elements of Permit-to-Work (PTW)

Permit-to-work (PTW) must be able to communicate with those involved in the task given. The company that issuing safe work permit shall design by consider individual site conditions and other requirements. Other than that, different tasks like hot work, cold work and confined space entry require separate permit forms to emphasize particular hazards present, precautions required and other legal requirement.

Major elements of permit-to-work form include: (i) Permit title & number; (ii) Job location; (iii) Plant identification; (iv) Hazard identification; (v) Precautions necessary; (vi) Protective equipment; (vii) Authorization; (viii) Extension / shift handover procedures; (ix) Approval; (x) Hand back (Chemical and Hazardous Installation Division, 2002).

Based on Industry Codes of Practice For Safe Working in a Confined Space 2010, additional element in permit-to-work form require following information; (a) the measures used to isolate the confined space and to eliminate or control confined space hazards before entry. These measures can include the lockout or tagging of equipment and procedures for purging, inerting, ventilating, and flushing confined spaces; (b) gas testing whereby it require initial and periodic atmospheric test results together with detail of authorized gas tester and an indication of test type performed;

(c) measures taken to isolate confined space; (d) standby personnel –firewatcher; (e) hot work precautions (Department of Occupational Safety and Health (DOSH), 2010).

2.4 Type of permit

2.4.1 Confined Space Entry

Confined space entry is defined as limited entrance to enter and exit that may present the personnel with potential safety hazards due to gases, vapors and physical hazards (Erickson, 1996). Definition by Occupational Safety and Health Administration (OSHA) regulation described confined space entry as space that: (1) sufficiently large for personnel to enter and conduct assigned task; (2) is not designed for continuous use; (3) has limited access and egress (Occupational Safety and Health Administration, 1993).

Common examples of confined space in process industry are reservoirs, silos, manholes, vats, pits, sewers, piping, crawl spaces and tanks (National Institute for Occupational Safety and Health (NIOSH), 1994). General activities associated with confined space as stated by Department of Occupational Safety and Health (DOSH) are; (a) sludge cleaning and other waste material; (b) physical integrity of process equipment inspection; (c) maintenance work that include blasting and coating; (d) repairing such as welding and modification to mechanical equipment; (e) rescue of workers who are injured in the confined space and (e) construction purposes (Department of Occupational Safety and Health (DOSH), 2010).

2.4.2 Hot Work

Activity that is performed in an isolated location where resulting in the generation of fire, explosion, toxic fumes and other ignition sources and having sufficient energy to cause ignition and affect surrounding community is described as hot work activity (Erickson, 1996) & (KLM Technology Group, 2013).

The areas that are potentially hazardous during hot work activity include, but not limited to well heads, fuel tanks, mud tanks, tank batteries, gas separators, oil treaters and confined spaces where gases can possibly accumulate (OSHA, n.d.). Some common activities in hot work are welding, cutting, burning, using fire or spark-producing tools or any work that produces a source of ignition (OSHA, n.d.).

2.4.3 Cold Work

Generally, cold work is described as activities that dealing with hazardous maintenance work but do not involve with hot work. Another definition is when there is no reasonable source of ignition, and when all contact with harmful substances has been eliminated or appropriate precautions taken (Government of Alberta, 2010). Common examples of cold work are civil & mechanical maintenance work, insulation and painting, erection removal of scaffolding, opening vessels, pipes or enclosed spaces, air conditioning services and troubleshooting work on energized electrical equipment between 50V and 480V (Muazzam, 2012).

2.5 Incidents due to Permit-to-Work (PTW) System

Several studies have shown that deficiencies in implementing PTW system contributes to catastrophic incidents. One of the cases stated by (Iragam Reddy, 2015) is the Piper Alpha disaster in 1988. Explosion that led to large oil fires was occurred which is believed due to a massive leakage of gas condensate. It is understand that the pump was undergoing maintenance work, hence the safety valve had been removed where it caused the leak to occur. Based on initial response from industry, inadequate permit and lockout/tagout system resulted in gaps in multiple levels of safety. Other than that, lack of informal "between shift" talks had become an issue to the incident (Nasa Safety Center, 2013).

Another case study shows the deficiency in PTW system is Stockline Plastics Explosion on May 11, 2004 where the latent failures include insufficient risk assessment was performed along with weak health and safety procedure (Okoh & Haugen, 2013). Similar case was found in the same study at Pasadena in USA where the plant experienced a chemical release which subsequently formed flammable vapors and ignited, resulting in a vapor cloud explosion and series of further explosions and fires. Known as The Philips 66 Disaster, the investigation proved that the failure is due to non-compliance to industry isolation procedure along with site procedure, and inadequate Permit-to-Work (PTW) system (Lees, 2005).

The other studies also stated the root cause of the incident is due to no implementation on safe work permitting procedure on 2006 where three contract workers were killed and a fourth worker was seriously injured in an explosion and fire at the Partridge- Raleigh oilfield in Mississippi while installing a pipe between two oil production tanks. The explosion occurred as the hot work being conducted in the presence of a flammable atmosphere (Ness, 2015). If the management implement Permit-to-Work system adequately, it is believed that the incident can be avoided.

There are various studies stated that disastrous incidents in plant or operation occurred as part of inefficiency in Permit-to-Work system. Table 2.1 summarizes the list of incidents related to deficiency in PTW system as well as other factors.

Table 2.1: Catastrophic incidents and its causes of failure

Sources	Incidents	Causes of Failure
Nasa Safety Center (2013)	The North Sea Piper Alpha Disaster (1988)	• Inadequate permit and lockout/tagout system • Lack of communication issues
Okoh & Haugen (2013)	Stockline Plastic Explosion (2004)	• Insufficient risk assessment • Very weak health and safety procedure • Lack of maintenance
Jahangiri et al. (2015)	Hickson and Welch Accident (1992)	• Lack of Permit-to-Work Issuance • Lack of communication between operatives and management
Ness (2015)	Partridge- Raleigh Oilfield Explosion (2007)	• No safe work permitting procedure for hot work – No gas test conducted for flammable vapor • Unsafe work practices

Based on the above data, lack of implementation of PTW system has become the contributing factors to the cause of incidents.

2.6 Implementation of Electronic Permit-to-Work (e-PTW) System

Historically, permit-to-work system has been designed to be paper-based (Risktec Solutions, 2012). Paper-based permit is described as pre-printed permit form that are filled and signed off by authorized personnel as approval to conduct activities at site. As we move to the 21st century, invention of electronic solution has been used for managing permits and risk associated with maintenance and construction activities (Iragam Reddy, 2015). It is stated that e-permits are playing an increasing role in assisting organizations to accomplish effective management of hazards, and providing a step change in safety performance (Risktec Solutions, 2012).

At early of 1990s, the first electronic permit-to-work system was designed. In process industry, the transition of paper-based permit-to-work system to electronic permitting was led by petrochemical sector in UK. Currently, few major organizations that implement electronic permit-to-work system are; Chevron, Marathon Oil, British Petroleum, Qatar Gas, EQUATE, Kuwait Oil Company, Johnson & Johnson, Saudi Aramco, Royal Air Force, Rolls Royce, General Electric, ALSTOM, Petronas and Abu Dhabi Oil Company (Iragam Reddy, 2015).

The transition of adopting electronic permit-to-work (PTW) system has been influenced by few key conditions as follow; (a) Advancement of technology in term of communications and computer allowing the business to operate more efficient; (b) Dynamic global market that produce more tough business practices (Advanced Safety Applications & Procedures (aSap), n.d.). Typically, the format and content of paper-based permit can be adopted into electronic permit-to-work system.

The improvement of electronic permit-to-work system to the paper-based system provides a combination of amazing features including work order integration, risk assessment, isolation of hazardous activities, competency management, lesson learned and continual improvement.

Adopted from (Iragam Reddy, 2015) & (Advanced Safety Applications & Procedures (aSap), n.d.), **Table 2.2** compares key features of traditional paper based permit system and electronic permit-to-work system.

Table 2.2: Features of permit-to-work system (Iragam Reddy, 2015)

Features	Paper Based System	Electronic Permit System
Flexibility of designing permit format and contents	Y	Y
Printed hard copy available at worksite	Y	Y
Easy access to all permits for reference and review from each users' PC/desk	N	Y
Visibility of all work locations at a glance on screen	N	Y
Ensure compliance with authorization roles	N	Y
Ensure compliance with each permitting process steps	N	Y
Creating, review and approve permits without any person physically chasing responsible parties	N	Y
Ensure JHA and risk assessment prior to issue any permit	N	Y
Easy tracing of permits for review and audits	N	Y
Instantly identifying conflicts between permits and SIMOPS	N	Y
Ensure required fields are completed and readable	N	Y
Retrieving details of isolation points	N	Y
Quick access to live and expired/closed permits and JHAs	N	Y
Job Hazard Analysis and risk assessment integration	N	Y
Real time instant monitoring of active work locations	N	Y
Computerized Maintenance Management System Work Orders and Permit integration	N	Y
Easy scalability to other operations	Y	Y (additional cost)
No adverse effects in case of major power breakdown and server failure	Y	N
No impact in case of E-permit software malfunction	N	Y
Remote permit access and monitoring	N	Y
Multiple languages functionality	Y	Limited
Ensure competency based roles assignment	N	Y
Pre-populated Hazard Tree	N	Y
Record and easily accessible lessons learned	N	Y

2.7 Possible Factors of Non-Compliance in Permit-To-Work System

An effectiveness of implementation of Permit-to-Work (PTW) system rely on the consultation between management and other personnel. At the most cases, workers and supervisors do not always see the importance of PTW system as they have not been trained to recognize the added safeguards provided in the operation. The non-compliance in PTW system possibly due to the potential factors as listed below (Government of Alberta, 2010):

- All the potential hazards does not cover in the permit form
- Inadequate procedure issuance
- The person signing the permit has not inspected the operation to see if the isolation, lock-out or testing has been done
- Workers are not following or do not understand the requirement of the PTW, especially expiry time
- Auditing or enforcement is not done properly
- Permits are prepared too far in advance, or after the work has begun
- System is too complex for user

2.8 Comparison Studies on Factors Contribute in Successful Safety Management

There are limited studies conducted on factors contribute in compliance of permit-to-work. However, several past studies have discovered that implementation of successful safety management may prevent accidents. Thus, a comparison studies on factors contributing in successful safety management was undertaken to support the area of this study as it is believed that permit-to-work system is part of the safety management in a working environment.

A study in the context of construction industry in Malaysia explained higher compliance rates can be achieved through management commitment, organizational assurance, safety communication and leadership, effective safety training and motivation (Mat Zin & Ismail, 2012). Fernando and Janbi (2008) enhances the safety compliance can be improved based on employee contribution and effective safety feedback (Fernando & Janbi, 2008).

Another context of study done by Dahl & Olsen (2013) expressed that level of safety compliance on offshore platforms is influenced by leadership involvement in daily work operations. Research done by Kapp (2012) also indicated that greater leadership associated with greater compliance in safety.

In Safety Management System (SMS) scope, the study conducted by Mokaya (2009) highlighted the major influence in successful safety management system (SMS) is organizational management which comprised of conducting proper safety trainings (Mokaya, 2009). Another study adds factor such as financial limitation, safety culture and working conditions are prominent influences on SMS (Othman et. al, 2014).

As we understand that permit-to-work encourage safe delivery work at site, one study agree that employees' commitment to safety practices improve performance in

reducing occupational accident rates (Neal & Griffin, 2006). The statement was then supported by study conducted by Boughaba et.al (2014).

Up till now, there is very limited studies have been conducted regarding contributing factors in compliance of PTW system. Hence, the study will be conducted to identify the factors of non-compliance in PTW system that will support the potential factors as stated above.

Table 2.3 presents the summary of contributing factors toward successful safety management by various studies.

Table 2.3: Contributing factors toward successful safety management

Sources	Management commitment	Organizational assurance	Safety communication	Safety leadership	Safety training & motivation	Financial constraint	Safety behavior	Working condition
Boughaba et al (2014)	-	-	-	-	-	-	√	-
Dahl & Olsen (2013)	-	-	-	√	-	-	-	-
Fernando & Janbi (2008)	√	√	√	√	√	-	√	-
Kapp (2012)	-	-	-	√	-	-	-	-
Mat Zin & Ismail (2012)	√	√	√	√	√	-	-	-
Mokaya (2009)	-	√	-	-	√	-	-	-
Neal & Griffin (2006)	-	√	-	-	-	-	√	-
Othman et al (2014)	√	-	-	√	-	√	√	√

CHAPTER 3

METHODOLOGY

3.1 Introduction

Essentially, the design of PTW audit is done by assessing the use of permit-to-work (PTW) through cold, hot and confined space entry activities at the pipeline operator stations. This research is conducted semi-qualitative and quantitatively whereby data from audit and survey is collected. Throughout audit and survey conducted, the data will reflects the compliance of the system and obtaining the respondents awareness on the usage of permit-to-work (PTW) system. This quantitative method is chosen to collect data due to its flexibility to obtain result and opinion on the permit-to-work (PTW) system.

Operational framework is developed to describe a sequential process to accomplish the aim and objective of the research. The framework provides outline and give consistency to observe the objectives.

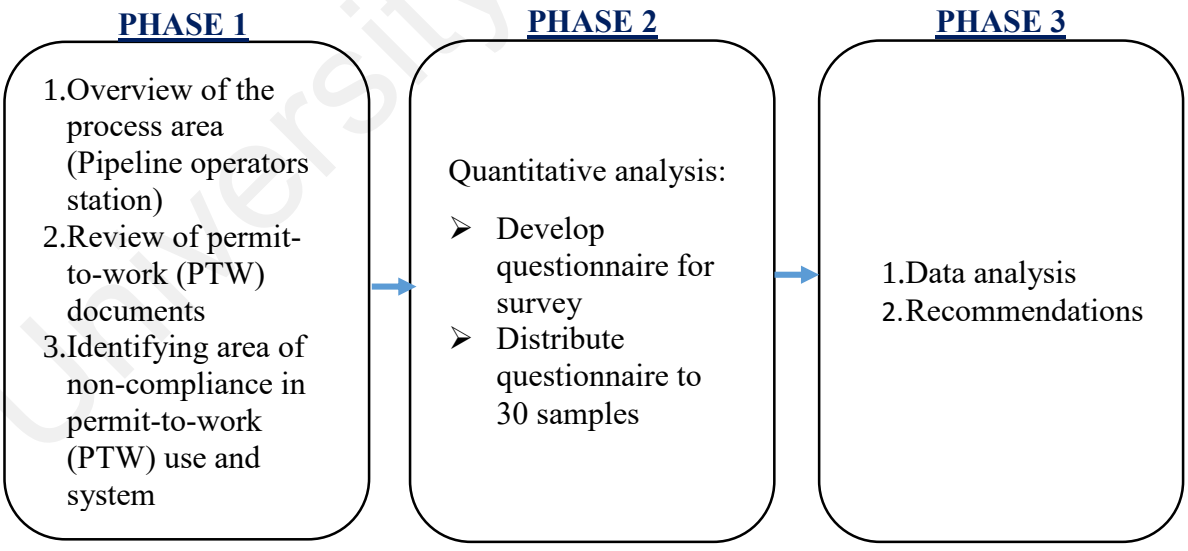

Figure 3-1 Operational Framework

3.2 Site Audit

The research study procedure mainly include audit approach to collect data and evaluate the compliance of PTW system. The audit is carried out in two phases which is known as planning and conducting phases. At the planning phase, a thorough review of PTW documents is done to gain information on the current practices at selected company. Preliminary interview is conducted among the workers in order to understand the management control and PTW process at the site. Besides putting information as a criteria base for assessment, the purpose of the planning phase is to develop a Risk-Based Audit program where it could provide a basis for the orderly, efficient and cost effective audit. Next, conducting phase includes the review of PTW documents and analysis of the area of non-compliance in PTW system based on the checklist audit that is divided into few sections as follow:

a) Section 1 – Requisition (information details of applicant)
b) Section 2 – Hazard / Hazardous activities (selection of hazard activities based on task)
c) Section 3 – Personal protective equipment (PPE) (selection of suitable PPE based on activities)
d) Section 4 – Supporting certificate / documents (related certificate and Job Hazard Analysis is attached in the system)
e) Section 5 – Worksite preparation/ precautions (details on the hot work permit no., authorized person etc)
f) Section 6 – Approval (Is activities approved by authorized person)
g) Section 7 – Revalidation of task (must renew every 24 hours), statement of gas testing result and confine space entry data
h) Section 8 – Hand back (Evaluation of proper hand back by applicant)

The details of each section is presented in PTW sample form from selected pipeline operator company as attached in Appendix B.

3.3 Survey

The study mainly include the employees working at the selected pipeline operator company. The total population at the selected pipeline operator company are 30 employees. Therefore, all 30 employees are selected as the samples for survey study. They are consists of 70% technicians, 20% engineers and 10% administration workers.

Survey is done in order to collect information from a sample of a population. This is done through structured questionnaires. The data is then collected once the questionnaire has been answered by all respondents. The questionnaire is distributed to all employee through designated link and they are given time to answer the questionnaires.

The aim of this questionnaire is to assess the safety awareness and behaviour of the workers on the implementation of PTW. The questionnaires will be structured as follow:

i. Part 1 – Evaluation on respondents' understanding on how the permit-to-work should be filled in, documentation required, authorized person and the validity of permit-to-work.
ii. Part 2 – Identifying how respondents know the risk and hazard associated with the works, valid certificates display by contractors as well as housekeeping practices.
iii. Part 3 – Awareness on precautions taken during hot work activities
iv. Part 4 – Identification on gas testing requirement during work

v. Part 5 – Evaluation on ease of electronic PTW system

This questionnaire will be based on a multiple choice question where the respondents answer with a simple "yes", "no" or "not sure/sometimes". The final question will ask respondents' suggestion or opinion on the current use of permit-to-work (PTW) system. The questions are displayed in Appendix A.

3.4 Limitation of study

As highlighted in Chapter 1, main limitation of this study is due to lack of previous researches regarding permit-to-work. By conducting this study, it will help to fill the knowledge gap in the literature review as well as describe the needs for further research study. Due to time constraint in conducting the study, the scope of research is limited to one area only which is Northern region. Hence, as the population is too small, all the employees are participated in this research especially in answering survey.

CHAPTER 4

RESULT

4.1 Permit-to-work (PTW) process flow

According to the PTW standard at the selected pipeline operator company, the order of activities before the PTW is issued may be vary depending on type of activities, however what is important is to get them done before permit issuance. In this study, PTW process flow is used as part of audit process to evaluate the compliance of PTW in the selected pipeline operator company.

Figure 4.1 shows the PTW process flow.

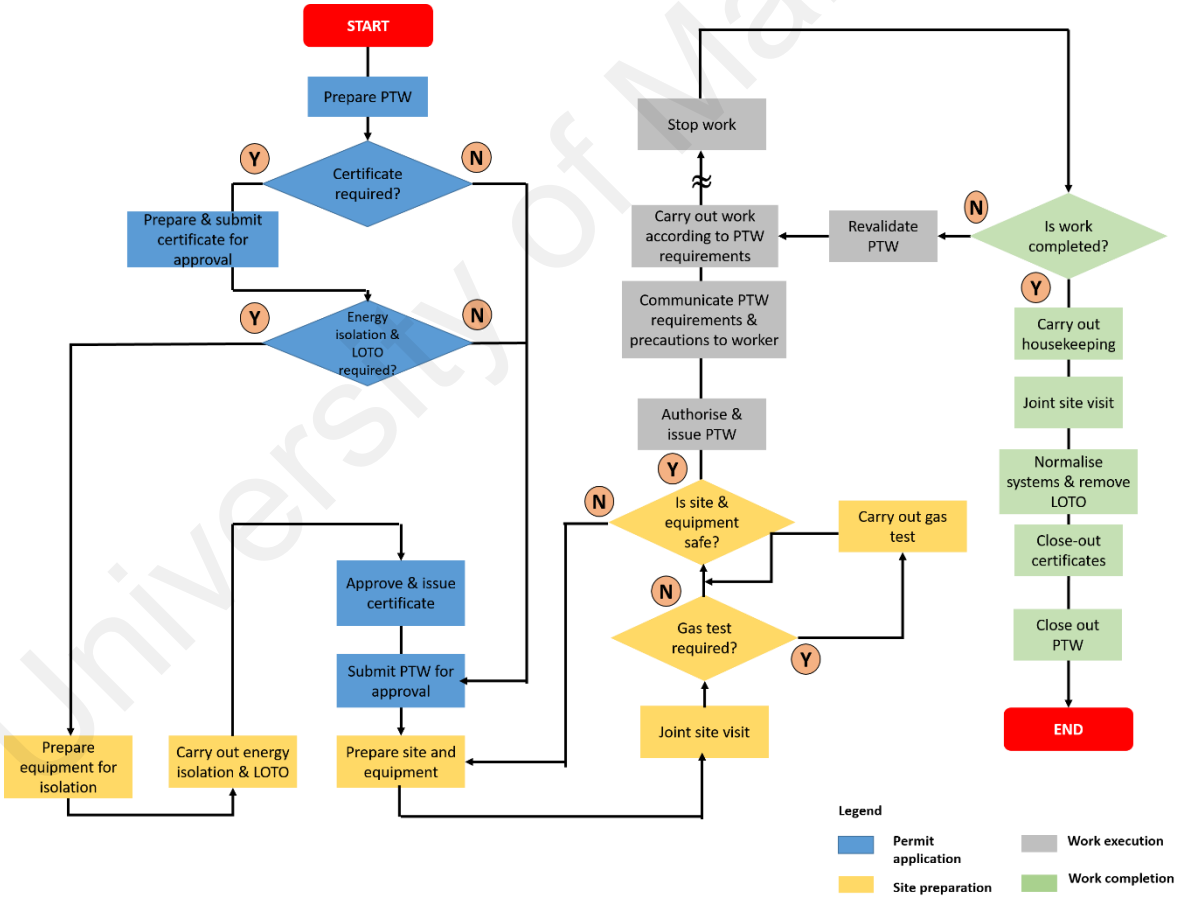

Figure 4.1: PTW process flow

4.2 Permit-to-work(PTW) audit result

The audit has been conducted and data on the application of permit-to-work based on company's standard has been collected. Besides, set of questionnaire has been distributed to employees to obtain the awareness of PTW system application. These data can be evaluated to show the total compliance of PTW in three years and level of employees' awareness on the PTW practices and system.

Permit-to-work audit has been conducted by going through the document of permit-to-work application in the system in three years. From **Figure 4.2**, it shows the percentage of compliance in the years 2015 to 2017. 2015 contributed around 86%, then peaked a little in 2016 about 87.83%, however declined by 6% in 2017. 2017 showed the lowest percentage compliance (81.83%).

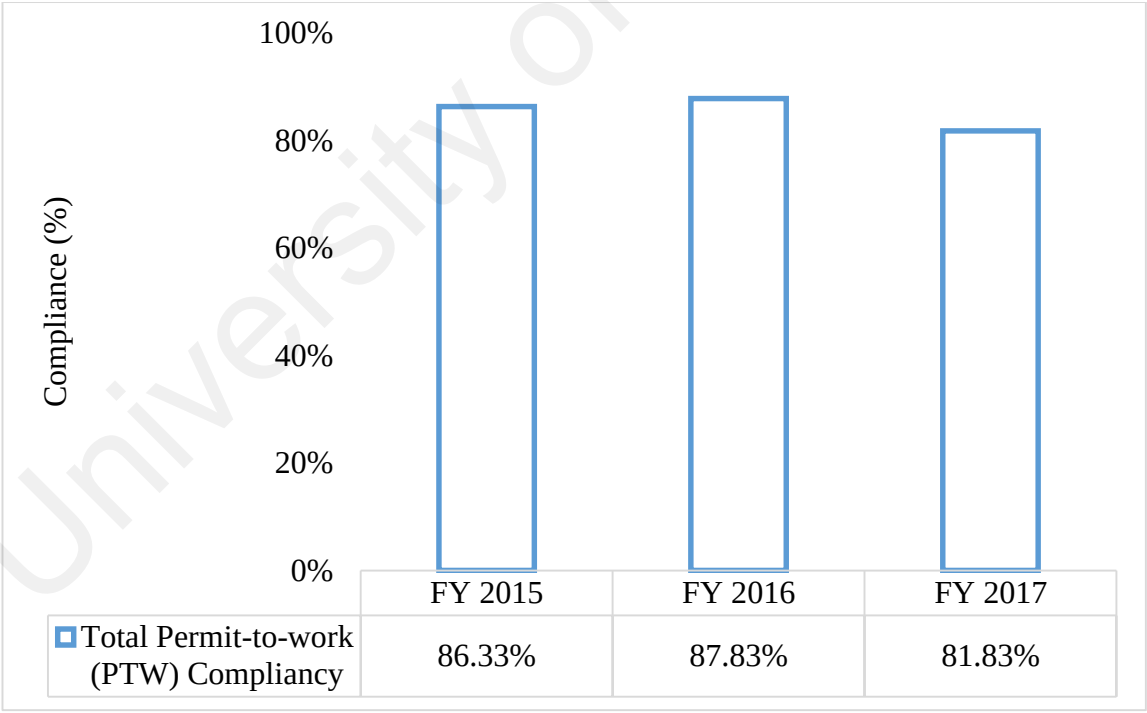

Figure 4.2: PTW compliance by year

In 2015, different trends can be seen in **Figure 4.3** whereby it describes PTW compliance from January to December. January compliance was about 90%, then drop to 84% in February. However, the compliance increased slightly to 90% and remained stable until May. Then, it decreased to 82% in June. From July to December, the compliance roughly steady from 86% to 90% compliance.

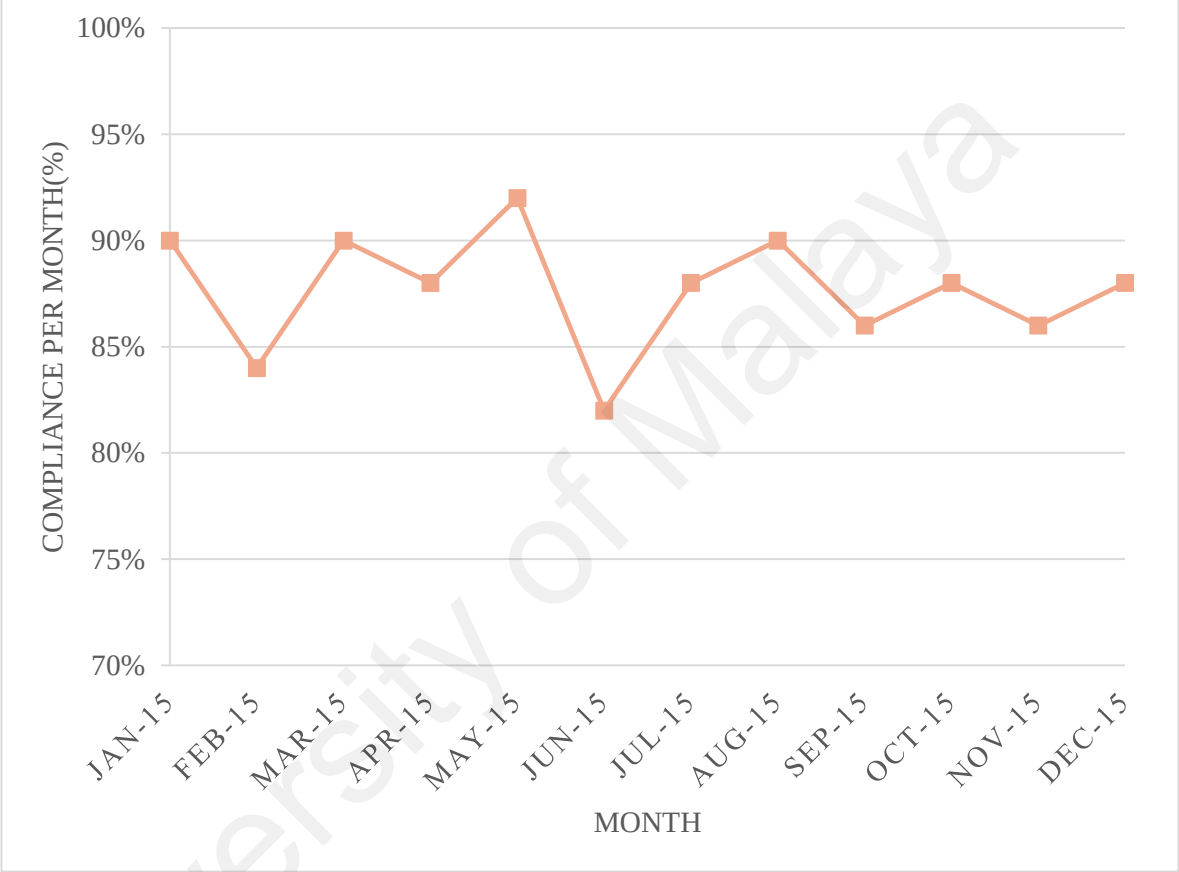

Figure 4.3: PTW compliance in 2015

Meanwhile, **Figure 4.4** represents PTW compliance in 2016. Even though compliance in January slightly low about 84%, it can clearly be seen that the compliance rising up and remained steady within 86% to 92% from February to October. However, there is small drop in November (84%) and increase back in December about 88%.

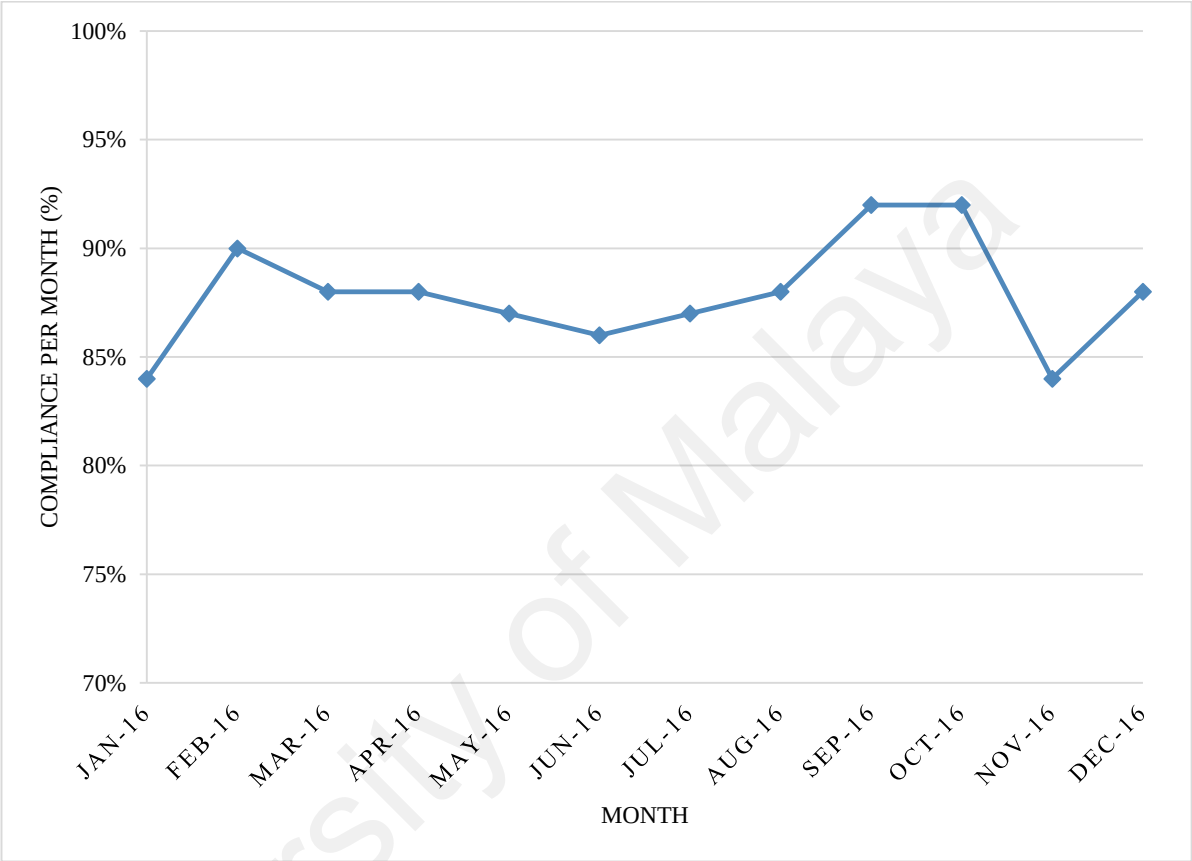

Figure 4.4: PTW compliance in 2016

2017 shows a different compliance trend as shown in **Figure 4.5**. The compliance remained steady at 82% from January to February. Then, it increased about 10% in March (92%) but suddenly drop to 75% in April. The compliance improved at 86% in May and keep rising to 96% in August. However, the compliance drop from 92% to 85% in September to November.

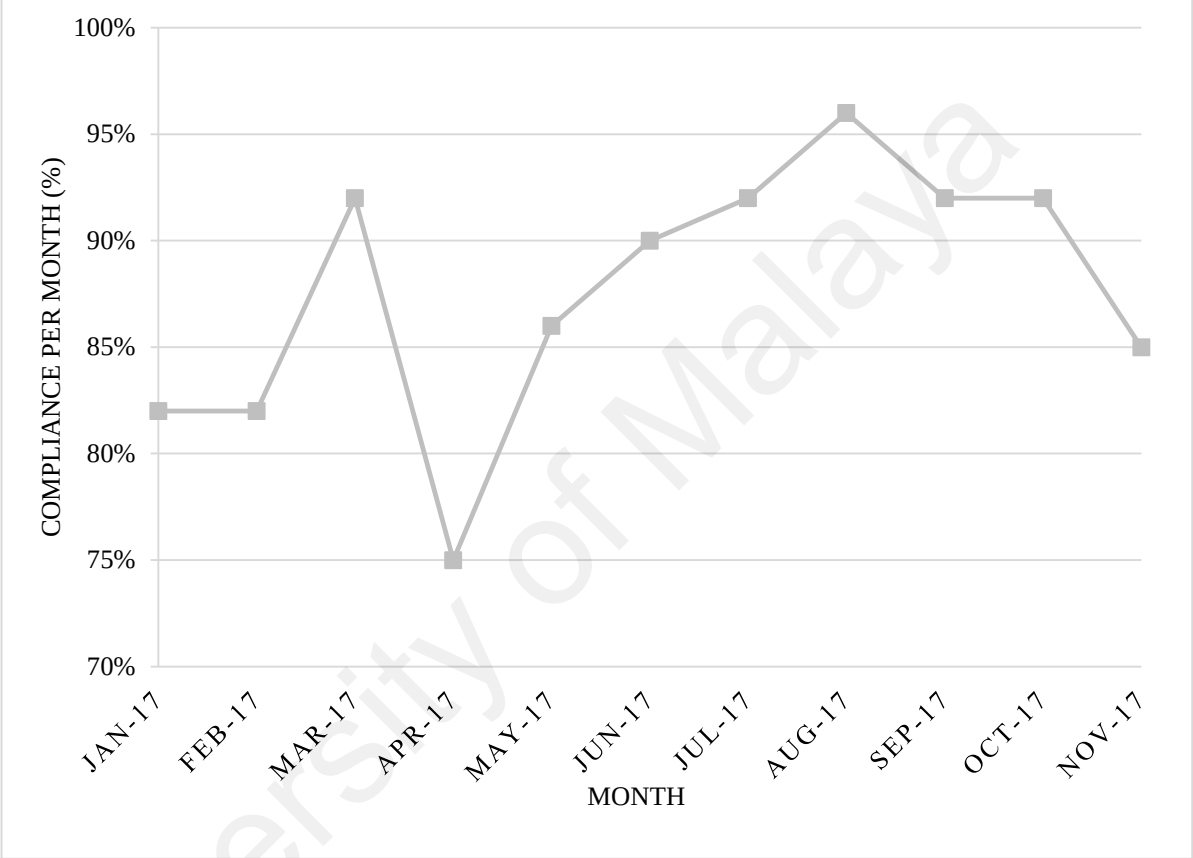

Figure 4.5: PTW compliance in 2017

On another scale, a comparison between hot work and cold work shows a very minimal difference as tabulated in **Table 4.1**. It represents 2% difference in 2015 and 2016 and similar compliance in 2017.

Table 4.1: Compliance of PTW based on permit type

Type of Permit	Year		
	2015	2016	2017
Cold Work	89%	87%	88%
Hot work	87%	89%	88%

Figure 4.6 clearly shows the difference compliance in both type of permit; hot work and cold work for 2015, 2016 and 2017.

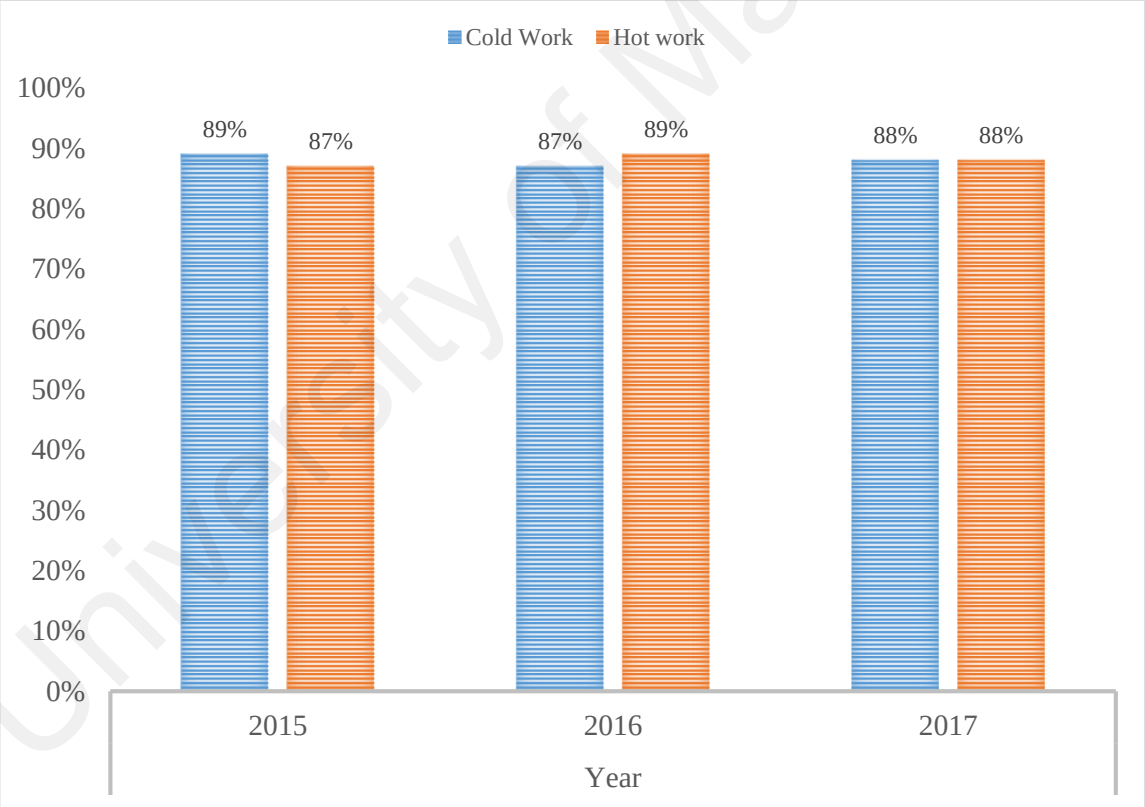

Figure 4.6: Cold Work & Hot Work Permit Compliance

In minute scale, analysis from the each section audited has been done as represented in Figure 4.7, Figure 4.8 and Figure 4.9.

Figure 4.7 represents the compliance in 2015. Requisition, Hazard/ hazardous activities, Personal Protective Activities, Worksite Preparation, Approval, Revalidation, and Initial Gas Test Result achieved 100% compliance. Hand back contributes the lowest compliance at 8%. Based on the audit, applicants do not submit documents during end of permit such as closed Job Hazard Analysis (JHA), hot work permit as well as related certificates based on job done. Supporting certificate and document only achieve 72% compliance. The non-compliance is due to certain document in the permit has already been signed during site verification (before job start) and few documents was not approved and verified by Reviewing Authority (RA) and Approving Authority (AA).

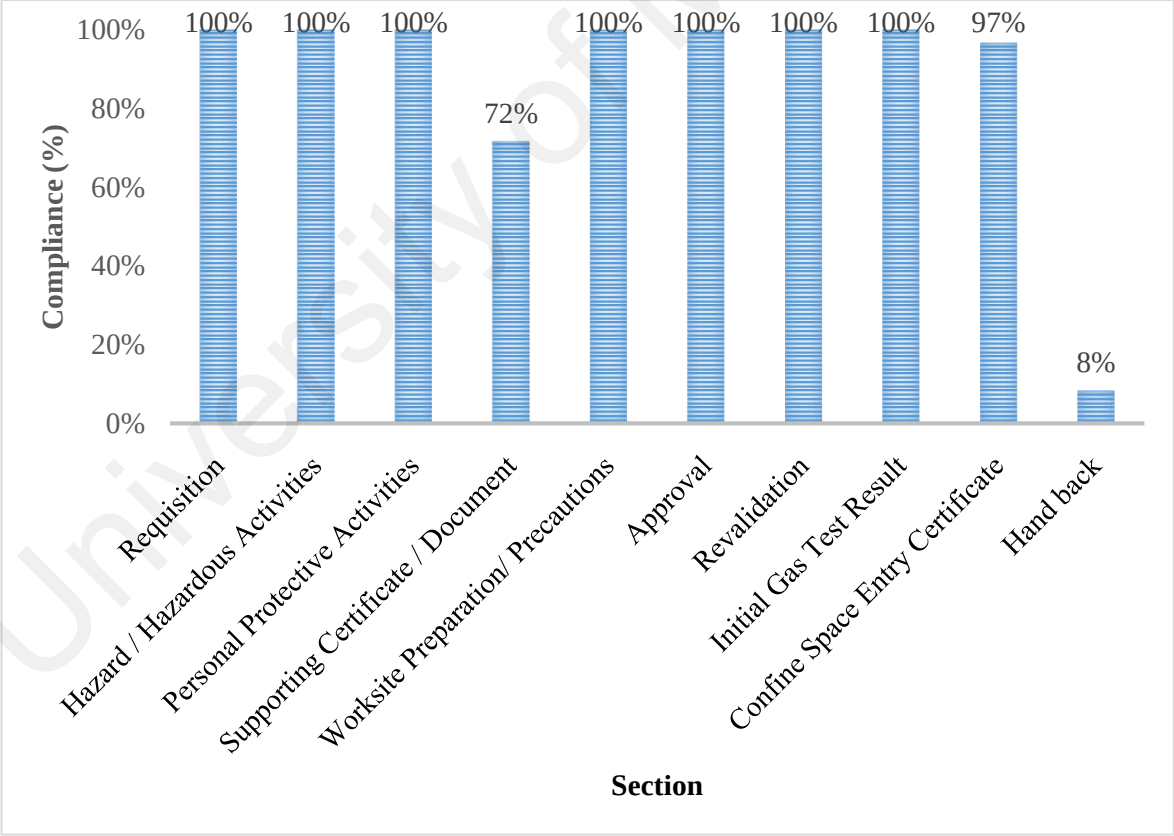

Figure 4.7: PTW compliance based on Section in 2015

In 2016, seven section contributes 100% compliance similar as 2015 which are Requisition, Hazard/ hazardous activities, Personal Protective Activities, Approval, Revalidation, Initial Gas Test Result and Confine Space Entry Certificate. 98% compliance was recorded at Section hot work permit. The non-compliance was tracked due to absence of joint site visit for hot work activity. Work preparation/ precautions contributed 75% compliance and 68% compliance in section supporting certificate/document. Again, hand back was recorded the lowest compliance which is 15% even though it increased slightly compared to 2015.

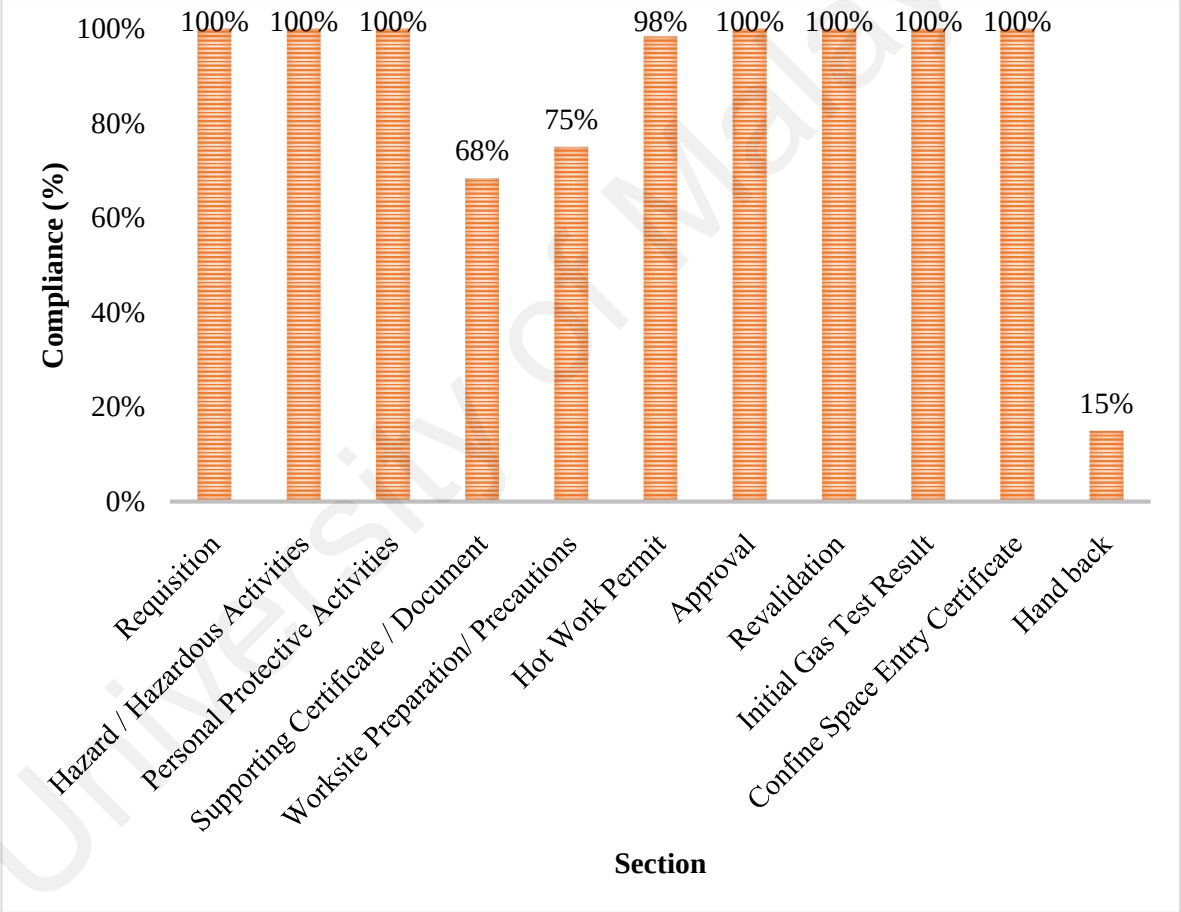

Figure 4.8: PTW compliance based on Section in 2016

As represented in **Figure 4.9** for 2017, no section achieve 100% compliance. Requisition, Hazard/ hazardous activities, Personal Protective Activities, Hot Work Permit, Approval, Revalidation, Initial Gas Test Result and Confine Space Entry Certificate contributed 92% and 93% compliance. Meanwhile, Section Supporting Certificate and Personal Protective Activities complied with 83% and 85%. As clearly seen in Figure below, hand back only complied about 27%.

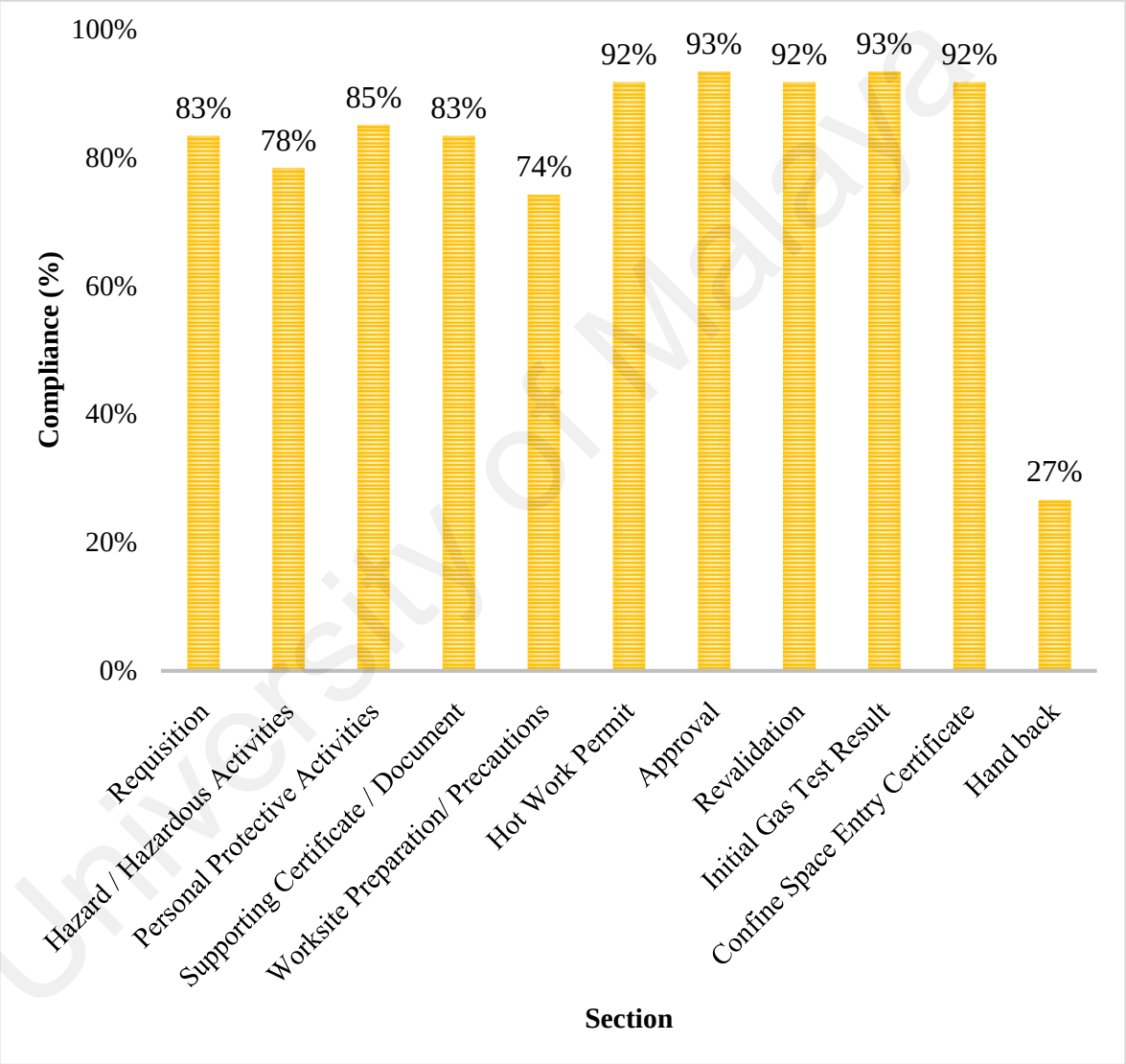

Figure 4.9: PTW compliance based on Section in 2017

4.3 Evaluation of awareness level towards PTW system

The PTW practices and system questionnaire was distributed to 30 employees to examine their awareness level towards permit-to-work and the ease of system. The response rate was 100% where all questionnaires were completed upon return.

As mentioned in the earlier chapter, the questionnaire comprised of five different parts with the total of 27 questions as shown in Appendix B. The analysis of the sections were further discussed as follow:

4.3.1 Administration & Organization

In this section, 7 questions were asked regarding the PTW as attached in Appendix B. Table 4.2 presented a summary responses from the employees in the selected pipeline operator company. The responses are based on simple "Yes", "No" and "Not sure/Sometimes".

Table 4.2: Summary of responses from employees in Part 1-Administration & Organization

	Description	Yes	No	Not sure/Sometimes
Q1	Form filled	100%	0%	0%
Q2	Consideration of document approval	97%	3%	0%
Q3	Appointment of PTW signatories before work	93%	3%	3%
Q4	Adequacy of permit training to work safely	40%	13%	47%
Q5	Display of authorized PTW signatories	67%	20%	13%
Q6	Document properly signed off	73%	3%	23%
Q7	Validity of PTW	97%	3%	0%

As can be seen in **Table 4.2**, all (100%) respondents understand on how to use and fill in permit-to-work (PTW) form as per Q1. However, based on Q4, 47% respondents not sure either the training they attended is adequate to work safely. Meanwhile, other questions achieve moderate numbers of agree whereby 67% workers know authorized PTW signatories should be displayed in the station/ office, 73% aware that documentations should be signed off when the job is completed, 93% respondents alert that approval & appointment of PTW signatories should be done before job start as well as 97% of them know PTW is valid within 7 days.

4.3.2 Implementation & Monitoring

In this section, questions were asked to evaluate how respondents implement permit-to-work (PTW) procedures during the work. Table 4.3 tabulated the summary responses of 30 respondents in implementing PTW.

Table 4.3: Summary of responses in Part 2 – Implementation & monitoring

	Description	Yes	No	Not sure/Sometimes
Q8	PTW implementation – work description	10%	83%	7%
Q9	Use of PPE by personnel	93%	7%	0%
Q10	Identification & precautions through JHA	90%	0%	10%
Q11	Approval & signature of JHA before work start	100%	0%	0%
Q12	Attachment of documents	93%	3%	3%
Q13	Tool box	90%	0%	10%
Q14	Revalidation of permit	97%	0%	3%
Q15	Proper hand back during completion	83%	0%	17%
Q16	Housekeeping practices	100%	0%	0%

83% of workers are highly understand on type of work that required PTW as described in their technical standard (Q8). 100% employees are knowledgeable on housekeeping practices after job done (Q16) and approval of Job Hazard Analysis (JHA) is required before conduct activities (Q11). Meanwhile, range of 3% to 17% are not sure about documentation during permit and hand back (Q10 – Q15).

4.3.3 Hot Work

Table 4.4 summarizes the responses on knowledge of hot work requirements.

Table 4.4: Summary of responses in Part 3 – Hot Work Requirement

	Description	Yes	No	Not sure/Sometimes
Q17	Prohibition of incompatible activities	43%	7%	50%
Q18	Firefighting equipment condition	43%	10%	47%
Q19	Drain cover	20%	13%	67%
Q20	Availability of running water	17%	13%	70%
Q21	Fire watch	90%	0%	10%

As clearly seen in Table 4.4, it can be concluded only average numbers of respondent know the hot work requirements. However, 90% of respondents aware that fire watch should present on site during the activities (Q21). On the drainage cover and running water provided at site (Q19, Q20), 67% and 70% are not sure about the requirement.

4.3.4 Gas Testing

At this section, **Table 4.5** summarizes the knowledge of respondents on gas testing requirement. Mostly, respondents understand on the gas testing requirement. Only 3% of employees do not know and not sure on the frequency of gas testing specified in PTW.

Table 4.5: Summary of responses in Part 4 – Gas Testing Requirement

	Description	Yes	No	Not sure/Sometimes
Q22	AGT certification and attachment	100%	0%	0%
Q23	Specification of gas testing frequency	93%	3%	3%

4.3.5 System Design

The purpose of evaluation on this section is to identify the feedbacks and current practices by respondents in PTW. As shown in **Figure 4.10**, 84% of respondents used PTW daily.

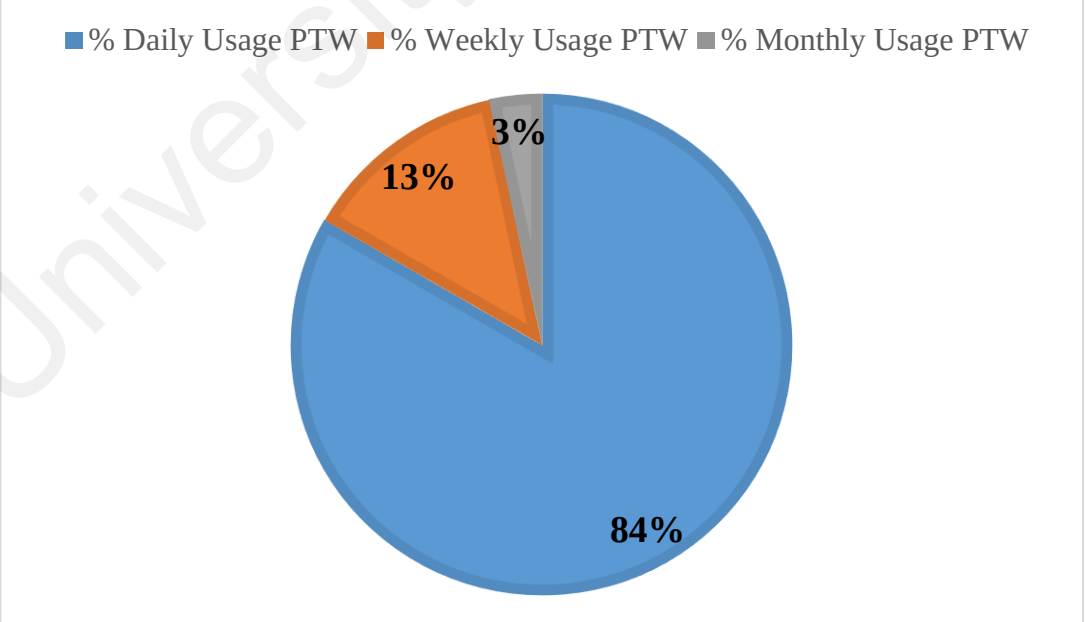

Figure 4.10: PTW Usage Frequency

Currently, electronic PTW (e-PTW) is being used in selected pipeline operator company. Hence, based on the survey provided, **Figure 4.11** represents the feedbacks on the design and effectiveness towards PTW usage.

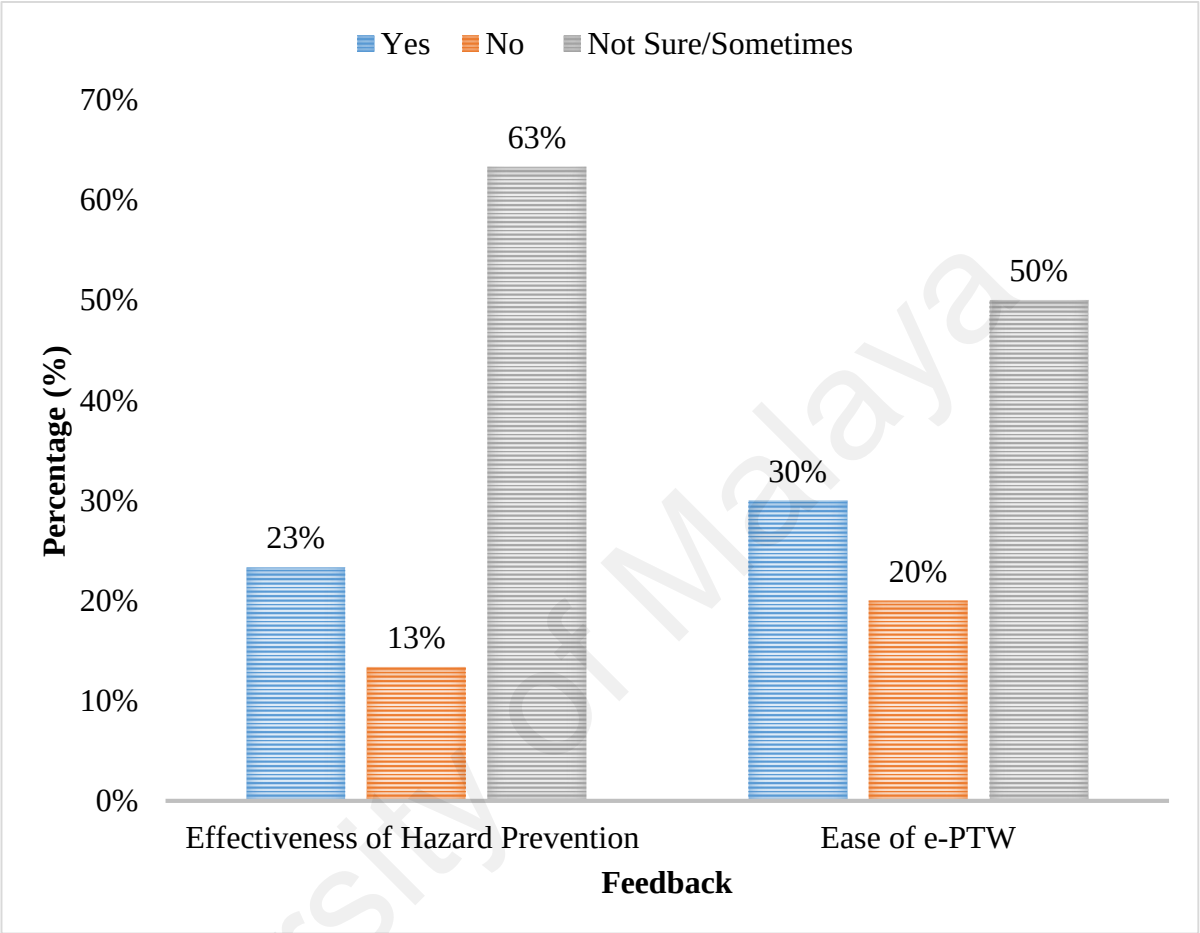

Figure 4.11: e-PTW design

As presented in **Figure 4.11**, 63% of respondents said they are not sure on the level of effectiveness of hazard prevention using the current system. Also, 50% of employee not sure the current PTW system is easy to use. Meanwhile 20% said the current system is not easy to use and 13% said it is not effective to prevent hazard. Remaining 30% comfortable using the current PTW system and 23% agree that the system is effective to prevent hazard on site.

At the end of the survey, respondents are providing suggestion and improvement on the current PTW. The suggestions are categorized in three category mainly; (1) User-friendly sytem, (2) Training sufficiency, (3) Enhancement / upgrading e-PTW. Table 4.6 presented the number of feedbacks.

Table 4.6: Suggestion / improvement on e-PTW

Code	Suggestion Category	Numbers of Feedback	Percentage (%)
C1	User-friendly system	8	32
C2	Training Sufficiency	2	8
C3	EPTW System Enhancement/Upgrading to meet PTW compliancy	15	60

There are 25 feedbacks and suggestions proposed in the questionnaire. 15 respondents suggest that the current PTW system should be enhanced and upgraded to meet 100% compliance. Another 8 employees requested the system to be more user-friendly and remaining 2 respondents suggest education and training on the system should be provided. Figure 4.12 presented the summary of suggestion based on category.

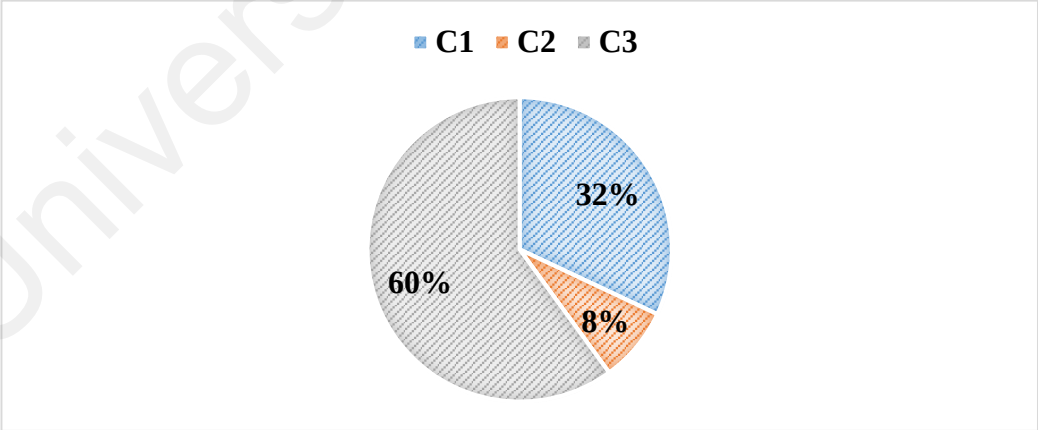

Figure 4.12: Suggestion on improvement of current e-PTW

4.4 Summary

As mentioned earlier in previous chapter, questionnaire is structured into few parts. Figure 4.12 summarizes the total responses based on each part.

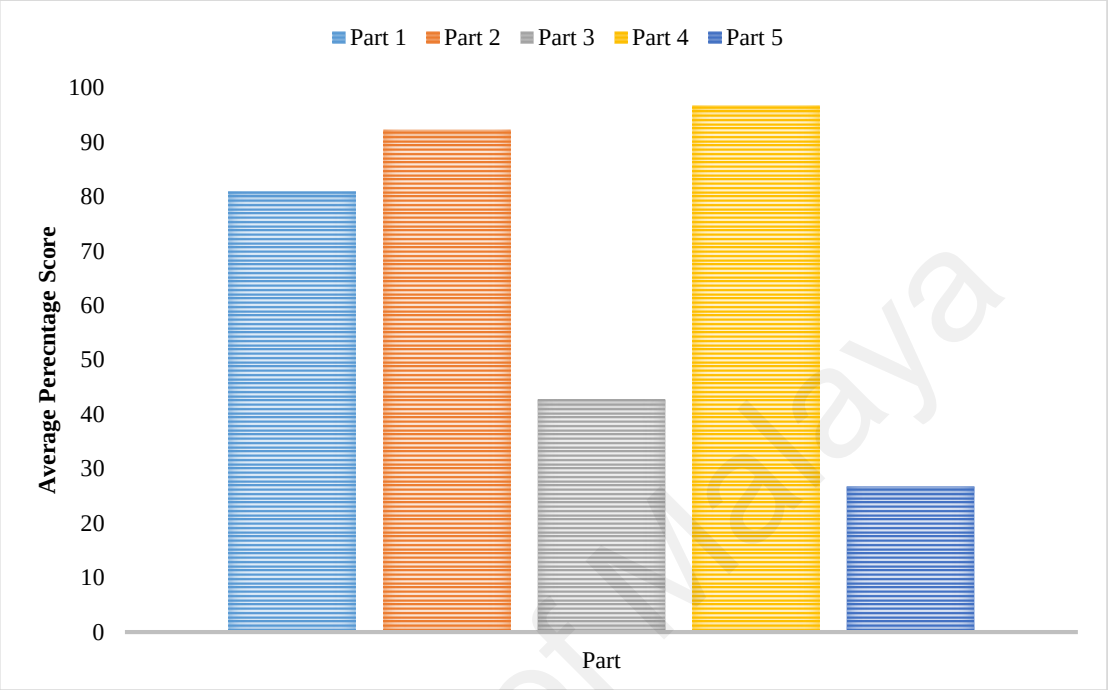

Figure 4.13: Summary of responses based on Section

It is clearly seen most of the respondents fully understand on the gas testing requirement whenever PTW is issued. 92% and 81% of respondents know to implement procedures and requirements before, during and end issuance of PTW. However, only 43% of employees understand hot work requirement on site. At last part of questionnaire, only 27% of respondents agree that the current e-PTW is effective to use.

CHAPTER 5

DISCUSSION

5.1 Audit on PTW

The audit gone through permit-to-work (PTW) that has been issued in three years which are in 2015, 2016 and 2017. Based on the data analysis that has been done, compliance in 2015 (86.33%) and 2016 (87.83%) shows about similar trend with a difference range of ± 2%. However, the compliance in 2017 drop to 81.83%. According to the trend, it can be clearly seen that the compliance has decreased by years. Hence, it can be concluded, based on (Health Safety Executive, 2005), the decrease happened due to complexity and non-suitable system design that contributes to low non-compliance. Kortens (2016) explained that e-PTW must be designed according to usability of user and complied with the requirement to ensure that all the benefits of speed, accuracy and ease of use are obtained.

Besides that, implementation of e-PTW has been started at the end of 2014 in the selected pipeline operator company. Thus, the decrease of non-compliance possibly occurred due to lack of refresher training on the PTW system procedures. Again, the result supported findings by Fernando & Janbi (2008), Mat Zin & Ismail (2012) and Mokaya (2009).Survey results also proved that 50% of respondents not sure on the ease of system usage. Mwita (2000) stated that the company's goal can only be achieved through good performance. Good result can be obtained through development of a good training design based on the need of employees (Partlow, 1996; Khan et al., 2011). Therefore, regular training may improve the compliance of PTW.

During the detailed assessment of audit, Section 4-Supporting certificates/ document and Section 8 – Hand back contributed the most non-compliance in PTW. The non-compliance of permit issuances are due to human behavior. Certain documents such as Job hazard analysis (JHA) already been signed by RA & AA before activities were conducted. There is also document that has not been approved by AA but the activities was conducted as usual. Ideally, the responsibility towards PTW system should rely with a person who has adequate time, resources and authority to organize the system (Gould, 2006).

During the hand back, the closure permit was not done properly as most of the permit did not attach such as closed Job hazard analysis, hot work permit certificates and other related document as required. This situation support the literature review narrated in previous chapter where workers are not following or do not understand the requirement of PTW (Government of Alberta, 2010). The results also supported findings that mentioned human behavior affect the level of compliance in safety management (Boughaba et al., 2014), (Fernando & Janbi, 2008), (Neal & Griffin, 2006) & (Othman et al., 2014). The level of compliance achieved in this study also reflects the employees' commitment to safety. As discussed by General Electric Capital Corporation (2012), it reflected the pride of ownership and workforce-wide understanding of company's goal.

5.2 Awareness level

Awareness of PTW practices and examination on the effectiveness of current PTW system is evaluated through survey of all 30 employees in the selected pipeline operator company at Northern region. The results obtained show that most of the employees are knowledgeable in following the requirement of PTW and fill in the information required in PTW.

However, it did not aligned with the audit results obtained. As stated by Neal & Griffin (2006), employees' commitment to safety practices improve performance in reducing occupational accident rates. Thus, it can be concluded that if employees contribute and committed in practicing permit-to-work, compliance of PTW can be improved.

On Hot work and gas testing requirement, almost 70% of respondents are not sure on the requirement. This part is very important to score as hot work is known as critical job in pipeline station. Safety training on this area should be conducted regularly. This is part of management commitment to arrange the training (Mat Zin & Ismail, 2012) as it is known safety training contributes on the success of safety management (Fernando & Janbi, 2008). Demonstration of safety training programs must be accompanied not only by commitment from management and resources, but employee involvement is also required to fulfill comprehensive hazard identification and risk management programs (AFPD, 2016).

On average, 63% of respondents are not sure either the current PTW system helps to prevent hazard on the site effectively. This possibly due to the design of the system itself. One respondent raised that electronic approval will not achieve the safety objectives if it is approved by those who is not on the site. Supposedly, PTW and site verification prior work commencement should be done by personnel available at site as they directly observe the potential hazard. Iragam Reddy (2015) stated electronic permit-to-work system provide work order integration, risk assessment, isolation of hazardous activities, competency management, lesson learned and continual improvement, however, it does not help in improving the compliance of PTW.

5.3 Recommendations based on audit findings and awareness level

Based on the result and analysis of the findings, there are several improvements can be suggested to increase the compliance of PTW. One of the improvement should be done by management is conducting regular refresher training. The training should be conducted at least each quarter of the year in order to improve the knowledge as well as manage to gather input for system enhancement from time to time.

Few studies by Apospori et al. (2008) highlighted training and development practices is important and Stavrou et al. (2004) have assumed organization's strategic role is based on training and development process. However, the studies by Cunha, et al. (2003) could not define training has impact on organizational performance.Besides that, more education on awareness and importance of working safely should be exposed to all level of worker.

Apart from that, the design of the system has to be revised and upgraded based on the requirement and procedures of PTW. The current system should restrict several action such as Section 2 is not enabled if Section 1 is not complied. This suggestion will force users to do it right at the first time. Another improvement is to upgrade the system by make it suitable based on the nature of the business as there are few section in the current PTW system is not aligned as what has been practiced by the selected pipeline operator company.

Last suggestion to improve the compliance is by integrating the system with electronic devices or creating phone application for the current system.

By implementing this way, users do not have to go back to admin office from their station that possibly too far, just to complete revalidation process.

CHAPTER 6

CONCLUSION & RECOMMENDATION

6.1. Conclusion

Permit-to-work audit has been conducted to evaluate compliance of PTW system. The scope of audit is based on Standard of work from the selected pipeline operator company itself. This study shows that the trend of PTW compliance dropped by years from 87.83% to 81%. Detailed assessment shows few parts of the audit scope achieved low percentage of compliance mainly at Section 4 and 8 – Supporting certificates and Hand back.

Then, a set of questionnaires were distributed to a population of 30 employees to examine the awareness level regarding PTW practice and usage of current system. On average, most of the respondents understand the procedures and requirement of PTW. However, average of 57% do not know/ not sure on the requirement of hot work and gas testing. On the current e-PTW system, only 27% agree it is effective to use.

The result of the study shows that compliance of permit-to-work is important to execute the work on-site safely. Several areas require improvement to achieve 100% PTW compliance in the future such as enhancement of system design, regular safety training to increase and improve employees' safety behavior as well as commitment from management.

6.2. Recommendation for future study

As this study focusing in the selected pipeline operator company at Northern region states of Peninsular Malaysia only, future research study can be improved to another region of Peninsular Malaysia as well as Sabah and Sarawak to analyze overall pattern of PTW application in the selected pipeline operator company.

Besides that, the current study focusing on the user of the system (e-PTW) through questionnaire, to further broaden the survey data in the future study, interview could be made with the system admin and authorized parties that govern PTW compliance which is Division Health, Safety and Environment department.

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Appendix A

Permit-to-Work (PTW) System Survey

The survey is intended to evaluate the awareness level on the permit-to-work (PTW) system at the workplace. Please answer all questions based on your knowledge and practice.

SECTION 1: ADMINISTRATION & ORGANIZATION

1. Do you ensure PTW form is signed and filled in?
    a. Yes
    b. No
    c. Not sure / Sometimes

2. Do you consider the approval of documents before contractors start the job?
    a. Yes
    b. No
    c. Not sure / Sometimes

3. Do you ensure PTW signatories are appointed before work begin?
    a. Yes
    b. No
    c. Not sure/ Sometimes

4. Does the permit training you attended is adequate for you to work safely?
    a. Yes
    b. No
    c. Not sure

5. Is the current list of authorized PTW signatories displayed at the PTW station/ office?
    a. Yes
    b. No
    c. Not sure

6. Are the PTW& supporting documentation signed off when the job is completed?
    a. Yes
    b. No
    c. Not sure/ Sometimes

7. PTW form is valid to use in 7 days. Is it true?
    a. Yes
    b. No
    c. Not sure/ Sometimes

SECTION 2: IMPLEMENTATION & MONITORING

8. Is the PTW being used for other work that is not described in the PTW?
    a. Yes
    b. No
    c. Not sure/ Sometimes

9. Are personnel using the correct PPE as specified in PTW?
    a. Yes
    b. No
    c. Not sure/ Sometimes

10. Are all hazards associated with the work identified and the necessary precautions specified through a risk assessment or JHA?
    a. Yes
    b. No
    c. Not sure/ Sometimes

11. Do we need to sign and approved Job hazard Analysis (JHA) before conduct activities?
    a. Yes
    b. No
    c. Not sure/ Sometimes

12. Are the supporting certificates, JHA, JMS and relevant drawings attached with PTW?
    a. Yes
    b. No
    c. Not sure/ Sometimes

13. Has tool box talk been conducted for the work?
    a. Yes
    b. No
    c. Not sure/ Sometimes

14. Has revalidation been carried out during shift change or if there is any change to the condition of permit?
    a. Yes
    b. No
    c. Not sure/ Sometimes

15. Upon completion of the job, has the PTW been signed off and handed back?

    a. Yes

    b. No

    c. Not sure/ Sometimes

16. Has the housekeeping been done after completion of the job?

    a. Yes

    b. No

    c. Not sure/ Sometimes

SECTION 3: HOT WORK

17. Have you ensure that incompatible activities e.g. atmospheric venting, draining, line breaking, sampling been prohibited at adjacent areas?

    a. Yes

    b. No

    c. Not sure/ Sometimes

18. Do you check firefighting equipment e.g. fire extinguisher, fire blanket available and in working condition?

    a. Yes

    b. No

    c. Not sure/ Sometimes

19. Do you confirm all adjacent drains covered?

    a. Yes

    b. No

    c. Not sure/ Sometimes

20. Is running water available at the site during hot work?

    a. Yes
    b. No
    c. Not sure/ Sometimes

21. Is the assigned fire-watch present at site?

    a. Yes
    b. No
    c. Not sure/ Sometimes

SECTION 4: GAS TESTING

22. Are the AGTs certified and attached in PTW?

    a. Yes
    b. No
    c. Not sure/ Sometimes

23. Is the gas testing frequency specified on the PTW i.e. continuous or at specified intervals?

    a. Yes
    b. No
    c. Not sure/ Sometimes

SECTION 5: SYSTEM DESIGN

24. How frequent do you use /assess PTW system per month?

    a. Less than 5
    b. 5 to 10 times
    c. More than 10

25. From your opinion, is the current PTW system effective to prevent hazard and risk at the site?

    a. Yes

    b. No

    c. Not sure/ Sometimes

26. Do you think electronic PTW system is easy to use?

    a. Yes

    b. No

    c. Not sure/ Sometimes

27. If not, what are suggestions to improve the system?

	0017855	PERMIT TO WORK - COLD WORK ONLY	
REGIONS / DEPARTMENTS :			

SECTION 1 - REQUISITION

Applicant's Name:
Staff No. / IC No.:
Location:

Location/Facility: Facilities
Equipment No: TMS
Area / Unit:

Required On	Expected Completion
Date: 26/07/2017	Date: 27/07/2017
Time: 10:45	Time: 17:00

☐ Non Process ☑ Process ☐ Utility

Dept./ Co: GTR
Tel No: 0176304967

Sap / W.Order No: 97896916-0240

Work Description:
Station Housekeeping

SECTION 2 - HAZARDS / HAZARDOUS ACTIVITIES (To be filled by WL / RA)

- ☐ Electrical Current
- ☐ Hydrocarbon
- ☐ Scaffolding
- ☑ *Other* : Grass cutting
- ☑ *Painting*
- ☐ H2S
- ☑ *Moving Equipment Parts*
- ☐ Slip and Fall
- ☑ *Chemical Handling*
- ☐ Hot / Cold Media
- ☑ *Noise*
- ☐ TENORM
- ☐ Heavy/Critical Lifting
- ☑ *Chemical*
- ☐ High Pressure
- ☑ *Loading / Unloading*
- ☐ Pressure Test
- ☑ *Biological*
- ☑ *Ergonomic*
- ☐ Calibration
- ☐ Manual Drilling
- ☐ Working at Height
- ☐ Flammable Material
- ☐ Cold Cutting
- ☐ Manual Excavation
- ☑ *Other* : Grass cutting machine

SECTION 3 - PERSONAL PROTECTIVE ACTIVITIES (To be filled by WL / RA)

Head / Eyes & Face Protection
- ☐ Face Shield
- ☐ Goggle
- ☑ *Helmet*
- ☑ *Safety Glass*

Respiratory Protection
- ☐ Airline Set
- ☑ *Dust Mask*
- ☐ Escape set
- ☐ Full Face Respirator
- ☐ Half Mask Respirator
- ☐ SCBA

Hearing Protection
- ☐ Ear Muff
- ☑ *Ear Plug*

Hand Protection
- ☐ Abrasive Object
- ☐ Chemical Glove
- ☐ Extreme Tempt.
- ☐ Sharp Object
- ☑ *Others* : Cotton & Rubber glove

Foot Protection
- ☐ Electrical Shoes/Boot
- ☐ Safety Rain Boot
- ☑ *Safety Shoes/Boot*

Body Protection
- ☑ *Apron*
- ☐ Chemical Suit
- ☐ Coverall made from Cotton
- ☐ Coverall made from Disposal Type
- ☑ *Coverall made from Fire Retardant*
- ☐ Life Jacket
- ☐ Life Vest
- ☐ Work Vest

Fall Protection
- ☐ Fall Arrest Eq.
- ☐ Full Body Harness (double lanyard)
- ☐ Safety Line
- ☑ *Other* : Aware working area

Others
- ☐ Other :
- ☐ Other :

SECTION 4 - SUPPORTING CERTIFICATE/DOCUMENT (To be filled by WL / RA)

Write the document No.

- ☐ Authority Clearance {DOHS(PTI),JKR,TNB,JPS,STM} :
- ☐ Box-up Cert / Document :
- ☐ Drawing No. :
- ☐ Electrical Isolation Cert :
- ☐ Excavation Cert :
- ☐ Interface Cert No :
- ☑ *Job Hazard Analysis (JHA)* : JHA
- ☐ Lifting Cert :
- ☐ Limit of Electrical Access (LEA) Cert :
- ☐ Physical Isolation Cert :
- ☐ Pre-Job Minutes Of Meeting / Kick Off Meeting :
- ☐ Previous PTW :
- ☐ Radiation Cert :
- ☐ Road Obstruction Cert :
- ☐ Safety Data Sheet (SDS) :
- ☐ Safety System Bypass/Override Cert :
- ☐ Vehicle Entry Cert :
- ☐ Other :

Endorsed By RA: Name: Date: 26/07/2017 Time: 10:19

SECTION 5 - WORKSITE PREPARATION/PRECAUTIONS (To be filled by AA)

PRECAUTION TAKEN BY AA
- ☐ Electrical Isolation
- ☐ Flushing
- ☐ Notify surrounding parties
- ☐ Valve chain locked open/close
- ☑ *Other* : Follow JHA
- ☐ Equipment/line depressurized/drained
- ☐ N2 purge / steam out
- ☐ To be counter signed by :
- ☐ Valve isolation

CONDITION TO BE IMPLEMENTED BY RA / WL
- ☐ Available Tagging
- ☑ *Contact Area/Panel Operator/PGCC before work start*
- ☐ Equipment/Line spaded as per list
- ☐ Running water on
- ☐ Secure tools/materials against falling
- ☐ Others .....
- ☐ Barricade & place warning sign
- ☑ *Contact Area/Panel Operator/PGCC on completion*
- ☐ Lock Out & Tag Out (LOTO)
- ☐ Scaffold with green tags
- ☐ To be accompanied by Area Operator / AGTES

JOINT SITE VISIT BEFORE WORK START (To be filled by AA) ☐ YES ☑ NO

We have personally checked the area and equipment to be worked on and satisfied the work requested can be carried out safely.

RA / RA REPRESENTATIVE
Status:
Name:
Date:
Time:

AA / AA REPRESENTATIVE
Status:
Name:
Date:
Time:

SECTION 6 - APPROVAL

RECEIVING AUTHORITY(RA) / RA REPRESENTATIVE	APPROVING AUTHORITY (AA)	AGREEMENT BY WORK LEADER (WL)
Name: Status: Agree Date: 26/07/2017 Time: 10:26	Date: 26/07/2017	Name: Signat Date: Time:

SECTION 7 - REVALIDATION

Date	DAY SHIFT							NIGHT SHIFT						
	TIME	RECEIVING AUTHORITY(RA) / RA REPRESENTATIVE	APPROVING AUTHORITY (AA)	Return By RA		Acknowledge By AA		TIME	RECEIVING AUTHORITY(RA) / RA REPRESENTATIVE	APPROVING AUTHORITY (AA)	Return By RA		Acknowledge By AA	
26/07/2017	10:26													
27/07/2017														
28/07/2017														
29/07/2017														
30/07/2017														
31/07/2017														
01/08/2017														

SECTION 8 - HAND BACK (To be filled by RA / WL) (PTW to be closed within 24 hours upon work completion / permit expiry)
(PTW to be closed within 48 hours of Incomplete/ supspended work without any activity at work site)

☑ Work completed ☐ Incomplete hand-back (equipment status, reason for hand-back, etc) ☑ Housekeeping completed

Remark:

ENDORSED BY RA	ACCEPTED BY AA
Name: Date: Time: 10:56	Date: 27/07/2017 Time: 10:58

STOP WORK AND EVACUATE AREA ON HEARING OF EMERGENCY ALARM