

**DETERMINATION THE LEVEL OF KNOWLEDGE,  
ATTITUDE AND PRACTICE TOWARDS HAZARDOUS  
CHEMICALS AND THEIR HEALTH EFFECTS AMONG  
OFFSHORE WORKERS IN OIL AND GAS INDUSTRIES**

**BY**

**WAN AHMAD SUBKI BIN RAZALI**

**A thesis submitted in fulfilment of the requirement for the  
degree of Master of Biobehavioral Health Sciences**

**Kulliyyah of Nursing  
International Islamic University Malaysia**

**DECEMBER 2020**

## ABSTRACT

**Introduction:** This research was conducted in order to measure level of knowledge, attitude and practice (KAP) discerned by the people who are working in Oil and Gas (O&GO) field at offshore petroleum platform towards hazardous chemicals. There were few related researches had been published but most of them were focusing on occupational safety in the platform as a whole and none of the study is focusing on KAP towards hazardous chemicals and health complications. This study discovered the level of KAP on exposure of hazardous chemicals, the association of social demographic data (SDD) which were age, academic qualification, working position and experience with KAP, the association of knowledge with attitude, knowledge with practice and attitude with practice among the workers towards hazardous chemicals and the commonest health effects related to the workers. **Method:** A cross-sectional study was conducted among 130 offshore workers in Petronas Carigali Sdn. Bhd., Kerteh, Terengganu using convenience sampling method. Well-structured questionnaires were distributed among the participants and all data were further analysed by using SPSS software and the association between the variables were tested using Chi-square test. **Result:** The KAP level of the workers in percentage was high (96.15%) for knowledge and excellent in attitude (93.85%) and practice 96.15%). There was an association between SDD (working position) with level of practice ( $p=0.032$ ) among the offshore workers. In addition, there was also a significant association between level of attitude with their level of practice ( $p=0.002$ ). The finding reveals there was no association between other SDD with level of KAP. There was no association found between level of knowledge either with level of attitude or level of practice among the offshore workers. **Conclusion:** Working position may have significant effect in determining individual level of practice in performing the roles. The level of attitude also may affect individual level of practice as being manifested based on the result. Respiratory irritation was the highest of most known hazardous chemicals to health among the offshore workers, followed by immune system disorder. In the future research, the level of KAP can be measured among onshore workers as well in order to compare the quality and attributes in performing their roles towards hazardous chemicals. This is to ensure people who are working in oil and gas sector will be equipped with excellent KAP level.

## خلاصة البحث

المقدمة: تم إجراء هذا البحث من أجل قياس مستوى المعرفة والمواقف والممارسات التي يدركها العاملين في مجال النفط والغاز في منصة النفط البحرية تجاه المواد الكيميائية الخطرة. وقد نشرت البحوث ذات الصلة ولكن معظمها يركز على السلامة المهنية في المنصة عاما ولم يركز أي منها على المعرفة والمواقف والممارسات تجاه المواد الكيميائية الخطرة والمضاعفات الصحية. وجدت هذه الرسالة أن هذه الدراسة مستوى المعرفة والمواقف والممارسات بشأن التعرض للمواد الكيميائية الخطرة، وربط البيانات الديموغرافية الاجتماعية (SDD)، التي كانت تتعلق بالعمر والمؤهلات الأكاديمية والوظيفة والخبرة، مع مستوى المعرفة والمواقف والممارسات، وربط مستوى المعرفة مع المواقف او الممارسات لدى العمال تجاه المواد الكيميائية والربط بين المواقف والممارسات والآثار الصحية الأكثر شيوعاً المتعلقة بالعاملين. النهج البحثي: أجريت هذه الدراسة المقطعية على 130 عاملاً في منصات شركة بتروناس النفطية في البحر في Petronas Carigali Sdn. Bhd، Terengganu، Kerteh باستخدام طريقة أخذ العينات المرنة حيث تم توزيع نموذج اسبيان على العمال الراغبين بالمشاركة وتحليل جميع البيانات باستخدام برنامج الحزمة الإحصائية للعلوم الاجتماعية (SPSS) وتم استخدام اختبار مربع كاي (Chi-square) لاختبار الارتباط بين المتغيرات. النتيجة: كان مستوى المعرفة والمواقف والممارسات لدى العاملين كان مرتفعاً (96.15%) للمعرفة وممتاز للمواقف (93.85%) والممارسة (96.15%). وكان هناك ارتباط بين البيانات الديموغرافية الاجتماعية (وظيفة العمل) مع مستوى الممارسات ( $p = 0.032$ ) لدى العاملين. بالإضافة إلى ذلك، كان هناك أيضاً ارتباط كبير بين مستوى المواقف ومستوى الممارسات ( $p = 0.002$ ). ولم يكن هناك ارتباط بين البيانات الديموغرافية الاجتماعية الأخرى مع مستوى المعرفة والمواقف والممارسات. وليس هناك ارتباط بين مستوى المعرفة سواء مع مستوى الموقف أو مستوى الممارسات بين العاملين. الخلاصة: قد يكون للوظيفة في العمل تأثير كبير في تحديد مستوى الممارسة الفردي في أداء الأدوار. وقد يؤثر مستوى الموقف أيضاً على مستوى الممارسة الفردي كما يظهر في النتيجة. بالنسبة للآثار الصحية كان من أكثر المشاكل الصحية التي يعاني منها العمال هو تهيج الجهاز التنفسي من المواد الكيميائية الخطرة، يليه اضطراب الجهاز المناعي. في المستقبل، يمكن للباحث قياس مستوى المعرفة والمواقف والممارسات لدى العمال في البر أيضاً من أجل مقارنة الجودة والسمات في أداء أدوارهم تجاه المواد الكيميائية الخطرة. هذا لضمان أن الأشخاص الذين يعملون في مجال النفط والغاز سيتم تجهيزهم بالمعرفة والمواقف والممارسات الممتازة.

## APPROVAL PAGE

I certify that I have supervised and read this study and that in my opinion, it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a thesis for the degree of Master of Biobehavioral Health Sciences.

.....  
Assoc. Prof. Dr. Muhammad Lokman Md  
Isa  
Supervisor

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a thesis for the degree of Master of Biobehavioral Health Sciences.

.....  
Asst. Prof. Dr. Nik Noor Kaussar Nik  
Mohd Hatta  
Internal Examiner

.....  
Dr. Nik Fakhuruddin Nik Hassan  
External Examiner

This thesis was submitted to the Kulliyah of Nursing and is accepted as a fulfilment of the requirement for the degree of Master of Biobehavioral Health Sciences.

.....  
Assoc. Prof. Dr. Salizar Mohamed Ludin  
Dean, Kulliyah of Nursing

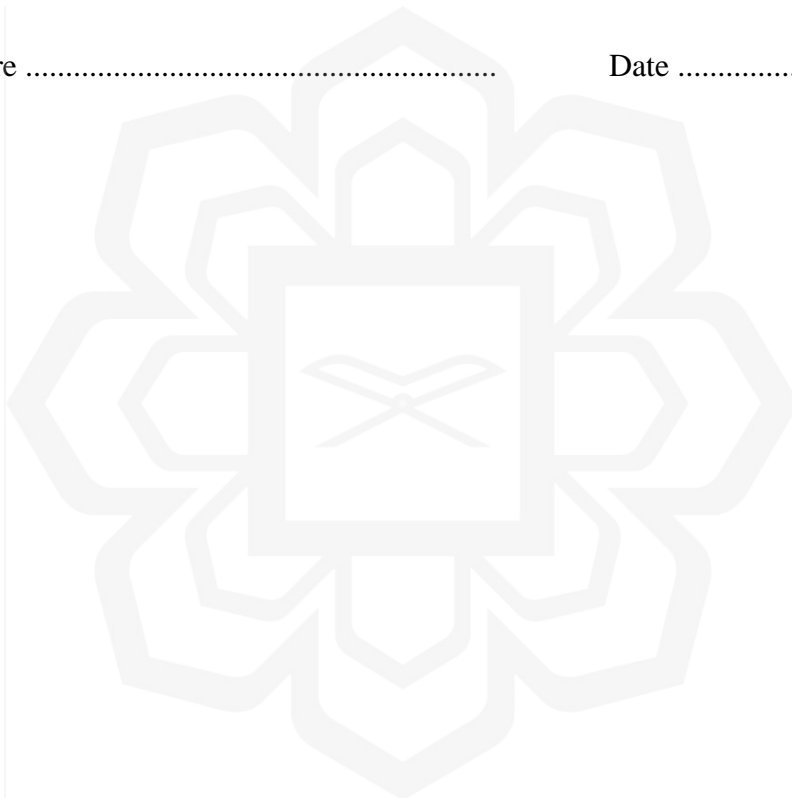
## DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at IIUM or other institutions.

Wan Ahmad Subki bin Razali

Signature .....

Date .....



**INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA**

**DECLARATION OF COPYRIGHT AND AFFIRMATION OF  
FAIR USE OF UNPUBLISHED RESEARCH**

**DETERMINATION THE LEVEL OF KNOWLEDGE,  
ATTITUDE AND PRACTICE TOWARDS HAZARDOUS  
CHEMICALS AND THEIR HEALTH EFFECTS AMONG  
OFFSHORE WORKERS IN OIL AND GAS INDUSTRIES**

I declare that the copyright holders of this dissertation are jointly owned by the student and IIUM.

Copyright © 2020 Wan Ahmad Subki bin Razali and International Islamic University Malaysia. All rights reserved.

No part of this unpublished research may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without prior written permission of the copyright holder except as provided below

1. Any material contained in or derived from this unpublished research may be used by others in their writing with due acknowledgement.
2. IIUM or its library will have the right to make and transmit copies (print or electronic) for institutional and academic purposes.
3. The IIUM library will have the right to make, store in a retrieved system and supply copies of this unpublished research if requested by other universities and research libraries.

By signing this form, I acknowledged that I have read and understand the IIUM Intellectual Property Right and Commercialization policy.

Affirmed by Wan Ahmad Subki bin Razali

.....  
Signature

.....  
Date

## ACKNOWLEDGEMENTS

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

First of all, I would like to praise to Allah s.w.t. because with permission that I could finish my research as planned. This project is one of the challenging tasks during my studies and it has taught me the meaning of patience, time management, courage and other good values.

I would like to express my sincere gratitude and appreciation to my supervisor, Assoc. Prof. Dr. Muhammad Lokman Bin Md Isa, for his patience and guidance throughout the completion of this research. Not to forget, to all lecturers who have directly and indirectly lend a helping hand in completing this project. Deepest gratitude to the petrochemical industrial's workers in Petronas Carigali Sdn. Bhd., Kerteh, Terengganu for participation in my study.

Finally, thank you to my families and friends for their warm support and guidance that had made this research project a memorable and an enlightening project.

# TABLE OF CONTENTS

Abstract .....	ii
Abstract in Arabic .....	iii
Approval page .....	iv
Declaration .....	v
Declaration of copyright .....	vi
Acknowledgements .....	vii
Table of contents .....	viii
List of tables.....	xi
List of figures .....	xii
List of abbreviations .....	xiii
<b>CHAPTER ONE: INTRODUCTION .....</b>	<b>1</b>
1.1 Background of the study .....	1
1.2 Statement of the problem.....	3
1.3 Research objectives .....	5
1.4 Research questions.....	6
1.5 Research hypothesis.....	6
1.6 Significance of the study .....	6
<b>CHAPTER TWO: LITERATURE REVIEW .....</b>	<b>9</b>
2.1 Overview of offshore industry.....	9
2.2 Hazardous chemical exposure and health complications at offshore platform .....	10
2.3 Hazardous chemicals exposure and safety in offshore and onshore.....	14
2.4 Knowledge of hazardous chemicals and the effects to the health .....	15
2.5 Attitude towards hazardous chemicals and health effects .....	18
2.6 Practice towards hazardous chemicals and health effects .....	21
2.7 Health effects of hazardous chemicals towards workers .....	25
2.8 Conceptual framework.....	27
<b>CHAPTER THREE: METHODOLOGY.....</b>	<b>29</b>
3.1 Introduction.....	29
3.2 Type of study .....	29
3.3 Study setting .....	29
3.4 Sampling method .....	29
3.5 Sampling .....	30
3.5.1 Population sample .....	30
3.5.2 Sample size .....	30
3.6 Inclusion criteria .....	31
3.7 Exclusion criteria .....	31
3.8 Research instrument.....	31
3.9 Variables .....	32
3.9.1 Dependent variables.....	32
3.9.2 Independent variables: .....	32
3.10 Reliability and validity .....	33

3.11 Ethical consideration .....	33
3.12 Data collection .....	33
3.12.1 Phase 1 .....	33
3.12.2 Phase 2 .....	33
3.13 Data analysis .....	34
<b>CHAPTER FOUR: RESULTS .....</b>	<b>36</b>
4.1 Introduction.....	36
4.2 Socio-demographic characteristics and the level of knowledge, attitude and practice of the workers.....	36
4.3 Association between socio-demographic factors (age, qualification, position, working experience) and level of knowledge towards hazardous chemicals and its health effects .....	38
4.4 Association between socio-demographic factors (age, qualification, position, working experience) and level of attitude towards hazardous chemicals and its health effects .....	40
4.5 Association between socio-demographic factors (age, qualification, position, working experience) and level of practice towards hazardous chemicals and its health effects .....	42
4.6 The possible known health effects due to hazardous chemicals exposure among offshore workers.....	44
4.7 Association between level of knowledge with level of attitude towards hazardous chemicals and its health effects .....	44
4.8 Association between level of knowledge with level of practice towards hazardous chemicals and its health effects .....	45
4.9 Association between level of attitude with level of practice towards hazardous chemicals and its health effects .....	46
<b>CHAPTER FIVE: DISCUSSION.....</b>	<b>47</b>
5.1 Introduction.....	47
5.2 Association between socio-demographic factors (age, qualification, position, working experience) and level of knowledge towards hazardous chemicals and its health effects .....	47
5.3 Association between socio-demographic factors (age, qualification, position, working experience) and level of attitude towards hazardous chemicals and its health effects .....	49
5.4 Association between socio-demographic factors (age, qualification, position, working experience) and level of practice towards hazardous chemicals and its health effects .....	51
5.5 The possible known health effects due to hazardous chemicals exposure among offshore workers.....	53
5.6 Association between level of knowledge with level of attitude towards hazardous chemicals and its health effects .....	53
5.7 Association between level of knowledge with level of practice towards hazardous chemicals and its health effects .....	54
5.8 Association between level of attitude with level of practice towards hazardous chemicals and its health effects .....	54
5.9 General discussion .....	55

<b>CHAPTER SIX: CONCLUSION</b> .....	<b>60</b>
6.1 Achievement of the study .....	60
6.2 Strength and limitation of the study.....	61
6.3 Recommendation .....	61
<b>REFERENCES</b> .....	<b>62</b>
APPENDIX A: PARTICIPANT INFORMATION SHEET .....	68
APPENDIX B: PARTICIPANT’S CONSENT FORM.....	74
APPENDIX C: QUESTIONNAIRE.....	76
APPENDIX D: APPROVAL LETTER.....	85
APPENDIX E: PRESENTATION AND PUBLICATION .....	86



## LIST OF TABLES

<u>Table No.</u>		<u>Page No.</u>
Table 2.1	Cancer-causing chemical substances	12
Table 3.1	Scoring scheme for level of knowledge, attitude and practice	32
Table 3.2	Statistical test for data analysis	35
Table 4.1	Socio-demographic data of respondents (n= 130)	37
Table 4.2	The level of knowledge, attitude and practice of the workers	38
Table 4.3	Association between socio-demographic factors (age, qualification, position, working experience) and level of knowledge towards hazardous chemicals and its health effects	39
Table 4.4	Association between socio-demographic factors (age, qualification, position, working experience) and level of attitude towards hazardous chemicals and its health effects	41
Table 4.5	Association between socio-demographic factors (age, qualification, position, working experience) and level of practice towards hazardous chemicals and its health effects	43
Table 4.6	Known health effects due to hazardous chemicals exposure among offshore workers	44
Table 4.7	Association between level of knowledge with level of attitude towards hazardous chemicals and its health effects	45
Table 4.8	Association between level of knowledge with level of practice towards hazardous chemicals and its health effects	45
Table 4.9	Association between level of attitude with level of practice towards hazardous chemicals and its health effects	46

## LIST OF FIGURES

<u>Figure No.</u>		<u>Page No.</u>
Figure 2.1	Conceptual framework of the study	28
Figure 3.1	Calculation of recommended sample size by Raosoft	30
Figure 3.2	Flow chart of data collection for this study	34



## LIST OF ABBREVIATIONS

ILO	International Labour Organization
GDP	Global Domestic Product
MSW	Municipal Solid Waste
O&G	Oil and Gas
EC	European Commission
GHG	Green House Gases
EWEA	European Wind Energy Association
UCLA	University of California at Los Angeles
USA	United States of America
OSH	Occupational Safety and Health
PPE	Personal Protective Equipment
MMI	Multi-Modal Interventions
VOC	Volatile Organic Compounds
BTEX	Benzene, Toluene, Ethyl Benzene, and Xylene
IAP	Indoor Air Pollution
AST	Amino Transferase
ALT	Alanine Amino Transferase
SPSS	Statistical Package Social Science
n.d.	no date
et al.	and others

# CHAPTER ONE

## INTRODUCTION

### 1.1 BACKGROUND OF THE STUDY

One of the most important milestones for the Malaysian oil and gas industry was the creation of Petroliam Nasional Berhad or also known as PETRONAS, with 43% of Malaysia's total production. The petroleum and natural gas mining industry recorded a total of 13,304 employees in 2011, which consists of managerial and professional, technical and supervisory, clerical, general workers, operative workers directly employed and operative workers employed through labor contractors (Department of Statistics Malaysia, 2012). Each of them especially the workers at offshore should know about the occupational safety and health organization to protect them from any accidents and cases. This type of worker is exposed to hazardous chemicals in any gas, water or solid form. Occupational hazards like exposure to chemical, biological and radiological agents are a concern and rated according to the severity of the harm they cause – a significant hazard being one with the potential to cause a critical injury or death (Ontario Ministry of Labour, October, 2013).

The fascination of offshore work is the offshore petroleum workers are paid with the high income and being seen as prestige in their profession. However, the reality of the offshore petroleum workers, they are facing imminent dangers such as natural disasters (Cruz and Krausmann, 2009), fire and explosion (Høivik et al., 2009), psychological stress triggered by the work and continuous work shift (Berthelsen et al., 2015) as well as hazardous chemical exposure (Kirkeleit et al., 2010; Stenehjem et al., 2017).

In fact, offshore oil and gas industry work is well known as a life-threatening occupation especially when the offshore petroleum workers have to face with hazardous chemical exposure which can cause severe health complications such as acute myelogenous leukemia (Kirkeleit et al., 2008), oesophageal adenocarcinoma (Kirkeleit et al., 2010), lung cancer, cardiovascular disease (Dadashzadeh et al., 2014), lympho haematopoietic cancer (Stenehjem et al., 2015), skin cancer (Stenehjem et al., 2017) and mercury exposure (Farid and Yusoff, 2009).

Chemical is one of the hazards that always associated with most severe industrial accidents. A proper and better safety assessments and procedures need to be implemented to prevent severe incidents from occur at workplace. Chemical hazards receive less attention than other major hazards at offshore industry such as fires, explosions, platforms capsize and blow-outs with oil spills on the sea. A study conducted by the Cancer Registry of Norway reported that offshore workers have a higher risk in getting leukaemia due to the prolong exposure to benzene. Offshore workers with frequent contact to oil and oil products showed a higher frequency of skin illnesses (Lindooe & Stene, 2011). Department of Occupational Safety and Health (2016) reported that the highest occupational diseases and poisonings in Malaysia was noise-induced hearing disorders (74.5%), followed by occupational musculoskeletal diseases (4.5%) and occupational lung diseases (2.5%). From the data, it showed that chemical hazards might occurs at Malaysian offshore industry due to the reported cases of occupational lung disease among offshore workers.

This is the first attempt to evaluate the knowledge, attitudes and practices (KAP) towards hazardous chemical and health complications among offshore petroleum workers who are daily vulnerably exposed which may lead to the various health effects. The benefit of this study is to provide in depth knowledge of awareness to hazardous

chemical and health complications among offshore petroleum workers which could assist in educating and creating awareness with regards the exposure effects to them and environmental health safe practices in the open sea.

## **1.2 STATEMENT OF THE PROBLEM**

Despite the economic importance of oil and gas industry, many petroleum companies overlooked the health complications after exposure to hazardous chemical among offshore petroleum workers which are at risk for morbidity and mortality. Many previous studies were focusing on health effects of offshore workers especially in terms of shift work and psychological stress (Barnes et al., 1998; Ross, 2009; Harris et al., 2010; Fossum et al., 2013; Berthelsen et al., 2015).

Only several studies were carried out on health effects of offshore workers towards exposure to hazardous chemical (Glass et al., 2010; Dadashzadeh et al., 2014). In fact, hazardous chemical is one of the common hazards that can cause health complications to offshore petroleum workers (Vinnem et al., 2006; Dadashzadeh et al., 2014).

With regards to KAP study, most of the study done among offshore petroleum workers were focused on occupational safety in the platform as a whole (Mearns & Flin, 1995) and none of the study was concentrating on hazardous chemical and health complications. Interestingly, a study done on health complications specifically multiple sclerosis disorder among offshore workers was not related to exposure to crude oil (hazardous chemical) but it was occurred due to low education level. The authors explained that education level is usually associated with life style factor which could be the trigger to multiple sclerosis among offshore workers (Riise et al., 2011). Therefore,

it is clearly showed that the root of problem of exposure to hazardous chemical related to knowledge of the workers.

The main concern regarding this issue is many previous researches only focused on hazardous chemicals and health effects towards only certain fields such as agriculture, industrial hygiene, occupational medicine, waste recycling and municipal waste management except for oil and gases (O&G) field. This approach is unfair for those who work in onshore and offshore regions as they also need to be thought and educated regarding the health effects associated with hazardous chemicals encountered daily. Offshore workers are vulnerable and exposed directly to the hazardous chemicals every day while working at the platform and have a high risk for accident and explosion. In addition, most of the studies are merely focus on types of health effects occurred after being exposed with hazardous chemicals, however no available research associate to knowledge, attitude and practice perceived by the respondents.

Hazardous chemicals do have negative health effects towards human. A research conducted by Senthil et al. (2014) shows that among 482 healthcare workers; 81.5% individuals have been reported to exposed with hazardous chemicals, 93.9% has direct skin contact with infectious materials and 39% does not even recognize those work-related hazards. Uddin and Gutberlet (2018) mentioned that 74% out of 235 respondents experienced various kinds of occupation-related diseases such as stomach diseases, skin diseases, kidney diseases and back pain. 63% of the respondents were also having other health hazards such as cuts, broken bones, burns, eye problems and headache. The research was conducted in city of Ullaanbaatar, Mongolia. These percentages are clearly shows that more research needs to be done in order to equip knowledge regarding hazardous chemicals and health effects towards individuals.

Hence, to the best of researcher knowledge, there is no study have been done on elucidating the knowledge, attitudes and practices of hazardous chemical and health complications among offshore petroleum workers. Thus, the present study is essential in providing baseline quantitative data on offshore petroleum workers KAP towards hazardous chemical and health complications information knowledge for preventive and control measures. The finding of this KAP study will become a guideline for the offshore petroleum workers to be prepared in managing hazardous chemical properly by following all the rules and regulations as this is an important aspect for safety in the offshore industry.

Thus, this study should be conducted in order to measure level of knowledge, attitude and practice discerned by the people who are working in O&G field (offshore).

### **1.3 RESEARCH OBJECTIVES**

1. To determine the level of knowledge, attitude and practice towards hazardous chemicals and health effects among offshore workers in oil and gas industries
2. To investigate the association between socio-demographic data (age, qualification, position and working experience) with level of knowledge, level of attitude and level of practice towards hazardous chemicals and health effects among offshore workers in oil and gas industries
3. To identify the most popular health effects known by the offshore workers in oil and gas industries related to hazardous chemicals
4. To study the association between level of knowledge with level of attitude, level of knowledge with level of practice and level of attitude with level of practice towards hazardous chemicals and health effects among offshore workers in oil and gas industries

#### **1.4 RESEARCH QUESTIONS**

1. What is the level of knowledge, attitude and practice towards hazardous chemicals and health effects among offshore workers in oil and gas industries?
2. How socio-demographic data (age, qualification, position and working experience) associated with level of knowledge, level of attitude and level of practice towards hazardous chemicals and health effects among offshore workers?
3. What is the most popular health effects known by the offshore workers in oil and gas industries related to hazardous chemicals?
4. What is the association between level of knowledge with level of attitude, level of knowledge with level of practice and level of attitude with level of practice towards hazardous chemicals and health effects among offshore workers?

#### **1.5 RESEARCH HYPOTHESIS**

1. There is an association between socio-demographic data (age, qualification, position and working experience) with levels of KAP towards hazardous chemicals and health effects among offshore workers.
2. There is an association between level of knowledge with level of attitude, level of knowledge with level of practice and level of attitude with level of practice towards hazardous chemicals and health effects among offshore workers.

#### **1.6 SIGNIFICANCE OF THE STUDY**

The present study was held to determine the level of knowledge, attitude and practice of hazardous chemical and health complications among offshore petroleum workers. Quantitative data and information regarding offshore petroleum workers on KAP

towards hazardous chemical and health complications were used as a baseline for preventive and control measures in order to prevent accidental of hazardous chemical exposure. Knowledge, attitude and practice at working site are important to avoid any accident from occur at workplace.

The present study also contributes to the realization of development programs for offshore petroleum workforce in forms of knowledge production related to organizational practice and guidelines for action towards minimizing the hazardous chemical exposure. Occupational safety and health management system of organization can be improved through evaluation of KAP among the offshore workers. The common health complication can also be obtained from this study thus early precaution can be made such as reserving related medications and awareness program. Besides, by doing this study, it is hoped to reduce the potential human error and potential undesirable events in the offshore petroleum sector.

This study directly focused on level of KAP of hazardous chemicals and health effects among offshore workers of O&G plants in Kerteh, Terengganu. This study discovered whether the level of knowledge, attitude and practice on exposure of hazardous chemicals and health effects primarily related to the age, qualification, position and working experience of the workers. The results of the study may act as an indicator for the workers to increase their knowledge regarding the health effects of hazardous chemicals towards them. The offshore workers are also expected to apply enhanced attitude and practice safety measures in order to minimize any risks of negative health effects throughout their working condition.

Furthermore, this study may assist the higher authority or management of the offshore workers in providing proper education and training for them in minimizing the risks of bad health effects caused by hazardous chemicals. The workers may be

benefited from this study as they will gain knowledge and information as well as awareness regarding the effects of hazardous chemicals towards their health.



## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 OVERVIEW OF OFFSHORE INDUSTRY**

Oil was first discovered in Malaysia in 1910 in Miri, Sarawak. Malaysian government had initiated two important events that shaped the Malaysia's O&G industries which were Petroleum Development Act that had been approved by Malaysia's Parliament and the PETRONAS which had been established to manage the petroleum resources of the country and provides support in resource planning, marketing and distribution (Abdullah, 2012).

In oil and gas industry, the offshore work that occurs in the platforms is usually fixed platforms, semi-submersible platforms or floating structures. The offshore platforms usually comprise three main sections which are the drilling area, the process area and living accommodations (Smith, 2013). The offshore petroleum workers can be ranged from the engineers, supervisors, managers (Husin et al., 2012), occupational health safety officers (Flin et al., 1996), maintenance officers and process technician (Smith, 2013). The activities include exploration (Suslick and Schiozer, 2004), oil piping (Keprate et al., 2017), drilling operation (Bakke et al., 2013), production, maintenance (Okoh, 2015), operations and inspection (Tamin et al., 2017) in accordance with job scope or categories at the offshore platform. Depending on the job scope of staff, offshore petroleum workers are usually exposed to elements that affect their life, health and safety (Okoh, 2015). The elements such as hazardous chemical, air pollution and unusual weather conditions commonly affected them (Villasenor et al., 2003). Among these elements, hazardous chemical is one of the major hazard occurrence reported among offshore petroleum workers (Vinnem et al., 2006).

Occupational Safety and Health (Use and Standard of Exposure of Chemicals Hazardous to Health) Regulation 2000 had been implemented under Section 66 of OSHA 1994 to protect health and safety of workers from the exposure of chemicals hazards at the workplace. The act aims to provide legal framework for the employer to control and minimize the use of chemical hazardous to health, to set a standard workplace exposure to the safest level and to encourage an excellent management in managing chemical hazardous to health (Omar, 2016).

## **2.2 HAZARDOUS CHEMICAL EXPOSURE AND HEALTH COMPLICATIONS AT OFFSHORE PLATFORM**

Offshore workplace is very synonym with various different types of chemicals. Different types of chemicals exhibit different risks to the workers. The poisonous chemicals are usually known as toxic substances. There are several types of chemical hazards which are corrosives, explosive and poisonous chemicals that lead to short-term and long-term effects. The corrosives chemicals are acids and alkalis that may cause severe corrosion and burns to the workers. The explosive chemicals are the chemicals that may cause fires and explosions at the workplace. The poisonous chemicals are the chemicals that can cause short-term and long-term effects to exposed people. Short-term effects of poisonous chemicals are the chemicals that shows immediate symptoms after initial exposure to the chemicals such as problems with breathing, skin and eyes. The long-term effects of poisonous chemicals are the chemicals that sho delayed symptoms due to the incubation time after the exposure. The examples of poisonous chemicals with long-term effects are asbestos, alcohol, tar and some metals (mercury) (FalckNutec Netherlands B.V, 2008).

Various potential mode of hazardous chemical transmission in the offshore environment as revealed by many previous studies including inhaling aerosols and vapour or airborne (Dadashzadeh et al., 2014), water and skin contact (Rosenfeld and Feng, 2011). Specific hazardous chemical agents might be possible to cause health complications include hydrocarbon (Okoh, 2015), toluene and benzene (Hopf et al., 2012), polycarbon and mix chemicals (Rosenfeld & Feng, 2011). Usually in offshore platform setting, the most common chemical agent caused severe health complications is hydrocarbon (Anifowose et al., 2016; Dadashzadeh et al., 2014; Olsen et al., 2015). Hydrocarbon is carcinogenic and in fact there are several reported cases pertaining to cancer occurrence among offshore petroleum workers after exposure to this chemical agent (Stenehjem et al., 2017). Besides hydrocarbon, benzene has been reported to cause leukaemia among offshore petroleum workers in Canada, the United Kingdom and The United States (Glass et al., 2010). Another study reported the low concentration of toluene exposure can affect the central nervous system in offshore petroleum workers (Hopf et al., 2012). Other chemicals that can cause acute and chronic respiratory illness such as cardiac arrhythmia, obliterative bronchiolitis and unconsciousness are carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>) and methane (CH<sub>4</sub>), respectively (Dadashzadeh et al., 2014).

In Norway, a study on offshore workers on exposure to hazardous chemical suggested that chemical such as asbestos, silica dust, chlorinated hydrocarbon, volatile sulphur compounds, polycyclic aromatic hydrocarbon and mineral oils may cause oesophageal cancer. The study also reported that oesophageal cancer was significantly detected among upstream offshore operators but did not show any significant association with the age factor (Kirkeleit et al., 2010).