2015-07-10

The Relationship Between Technical Training and Developing Saftey Leadership Skills Among Onshore and Offshore Drilling Crews

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The Relationship Between Technical Training and Developing Safety Leadership Skills Among Onshore and Offshore Drilling Crews

by

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A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE

DEGREE OF DOCTOR OF PHILOSOPHY

GRADUATE DIVISION OF EDUCATIONAL RESEARCH

CALGARY, ALBERTA

JULY, 2015

Abstract

This research investigates the relationship between International Well Control Forum (IWCF) Rotary Drilling Well Control Training Program and developing safety leadership skills among onshore and offshore drilling crews. The research methodology is a qualitative case study. Following the University of Calgary Conjoint Faculties Research Ethics Board (CFREB) requirements, and with their approval, semi-structured interviews were conducted to collect the data. A total of 40 IWCF candidates were interviewed, with 10 from each of the following categories: surface driller, surface supervisor, subsea driller, and subsea supervisor. From the qualitative analyzed data eight themes emerged to explore whether there is a relationship between technical training such as IWCF training and developing safety leadership skills from the drilling personnel perspectives. The findings of this study indicate that IWCF Rotary Drilling Well Control as a technical training can definitely develop safety leadership skills in well control situations. Some believe this development could be transferred to other drilling and well operations whereas others believe it is strictly related to only well control operations. Nevertheless, this development cannot be generalized to other well control training programs. In terms of leadership style that must be used to develop safety skills, the findings of this research indicate that implementing a transactional or transformative leadership style is based on many factors including the individuals themselves, the company regulations, and the country legislation. Moreover, the findings present the main obstacles the respondents identified as preventing them from performing their job duties on the rig site and how the industry could avoid these obstacles to reduce deadly accidents. Additional research would be beneficial to examine whether IWCF training or other well control training could develop safety leadership skills among drilling crews by using a larger more ethnically diverse sample size.

Acknowledgements

My gratitude is expressed to many educators, friends and family who have supported me throughout the years to the completion of my doctoral program.

I would like to express my special gratitude to Dr. Ian Winchester, my supervisor. He is a remarkable educator. I would not have completed my dissertation without his guidance, advice, and support. I would also like to thank my supervisory committee at the University of Calgary for their support through the candidacy and dissertation preparation phases: Dr. Peggy Patterson and Dr. Veronika Bohac-Clarke. I also thank GDER staff for their great support.

I would also like to thank the research respondents who willingly gave me some of their time to participate in this research and shared their experience, thoughts, and opinions. Their participation helped me a lot to learn about the drilling personnel perceptions about IWCF certification. I would also like to express my appreciation to IOTS for allowing me to use their facilities to conduct the interviews and have access to IWCF candidates.

A special gratitude to Mr. Jack Gibbon, Senior Drilling Supervisor, who told me "do not give up on your idea and be the first one who examines IWCF training." Without his encouragement this research would be just a thought. A special thanks to Mr. Mike Pointing, Drilling Engineer at Shell, for his great support and advice.

Finally, I would like to express my gratitude to my father for his unconditional love and support. I would also like to thank all my friends for their contributed encouragement. Finally and most importantly, I thank my best and dear friends Benoit, Caden & Madison Babineau for their love, support, patience, and for bringing so much joy and happiness into my life.

I dedicate this Doctoral Dissertation to my father.

Your love has encouraged me throughout the thesis process and in my life.

& to my mother who passed away August 25, 2012.

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List of Abbreviations

Symbol	Definition
API	American Petroleum Institute
BHP	Bottom Hole Pressure
CRM	Crew Resources Management
D's M	Driller's Method
DPP	Drillpipe Pressure
EQ	Equipment
E&P	Engineering & Production
HSE	Health, Safety, and Environment
IADC	International Association of Drilling Contractors
IADC WellCAP	International Association of Drilling Contractors (IADC) Well Control training program
IWCF	International Well Control Forum
OIM	Offshore Installation Mangers
PA	Practical Assessment
P&P	Principles and Procedures
SI	Système Internationale or International System
W & W M	Wait and Weight Method

Chapter One: **Introduction**

1.1 Background Knowledge of the Research Problem

The background knowledge of the research problem can be presented from three critical perspectives: the importance of training for the drilling industry, main issues in the international oil and gas industry, and the implementation of safety standards during drilling operations.

1.1.1 The importance of training for the drilling industry

Intensive training in the drilling sector has become imperative, especially at the driller and drilling supervisor levels (Macmillan, 2000). This type of training also responds to the global appeal in terms of preparing each drilling crew for tolerating critical situations that might impact human lives, the environment, livelihood, and any natural resources (Flanders, et al. 1998). For instance, in April 2010, an explosion occurred on the Deepwater Horizon Oil Rig (Macondo) for British Petroleum (BP) in the Gulf of Mexico. BP's investigation team announced that an "interlinked of series of mechanical failure, human judgment, engineering design, and operational implementation and team interface failures" were the main causes for this explosion (BP's internal investigation, n.d, p. 1). However, other investigators blamed poor and ineffective leadership skills of the rig manager and a lack of communication between BP crew members (Lessons in Leadership from the BP Disaster, n.d)

Karish & Siokos (2004) highlighted four common root causes of an oil rig disaster as follows:

- Poor leadership and communication skills resulting in non-compliance with the instructions of the supervisor or rig manager.

- Irresponsible individual performance namely poor judgement, ignoring or breaking the rules, and a lack of concern for the implementation of routine tasks.
- Deficiency of equipment maintenance and neglect of safety rules.
- Inadequate safety policies or absence of safety policy that guides the workforce in their task application. (p. 1,2)

Most of the local and international drilling companies have recently been attempting to learn and to act on lessons from the BP accident and other damaged rig disasters. They have an increased awareness regarding the importance of safety training and development in order to improve their personnel safety, leadership, and communication skills, along with improving their abilities to perform the job duties. Considering this desire, a large number of training institutions and schools have been established to facilitate safety and applied trainings on demand (Crichton, 2005; Sutherland & Cooper, 1991). Studies such as Flin, et al. (2002) and Crichton (2005) claimed that the global concerns about the environment put massive pressure on decision makers in the oil and gas industry to consider every potential event that might affect the environment as a result of human error. Parker, et al. (2006) stated that the global concern of the safety approach to accident reduction emphasizes the role played by operational leaders in terms of ensuring the implementation of all safety aspects.

Karish & Siokos (2004) noted that the increased demand for improving safety through focusing on leadership encourages the drilling industry to invest in developing the safety leadership skills of their personnel, especially at the driller and drilling supervisor levels. This demand has been a market-driven approach, and is based on the success that past participants have reported and the difference they are making in the workplace after attending the safety and

technical training courses that show them efficient ways of performing their job safely (Karish & Siokos, 2004). In light of this increased emphasis on drilling operations safety, training has become very important in this industry. Consequently, safety leadership skills need to be continuously developed, modernized, and then provided to leaders to enhance the operational performance of all crew members at onshore and offshore rig sites.

Since the BP disaster in 2010, the concept of safety and leadership training in hazardous industries has attracted a great deal of research attention from a range of academic disciplines (Parker et al., 2006). Specifically Flanders, et al., 1998; Macmillan, 2005; O'Dea & Flin, 2001; Parker et al., 2006; Sutherland & Cooper, 1991, have all written articles on this topic. The perspectives taken and points of emphasis vary from the need for future research, to others that focus on safety standards and the safety leadership performance that must be developed in this industry.

Supervisors, site managers, safety officers, and consultants play major roles in implementing safety on worksites and supporting crew members to demonstrate their understanding for safety legislation. The National Safety Council (NSC) states that although the supervisors are the lowest level of management, they are a key element in preventing accidents by framing work routine, providing clear work instructions, distributing work roles based on the nature of task list, providing motivation and feedback to work safely, and by building good work relationships (Fleming, et al., 1996).

Many studies, such as Caroll and Hatakenaka, 2001; Health and Safety Executive, 2003; Hopkin, 1999; and Smallman and John, 2001, examined the relationship between leadership skills and safety performance at the supervisory level and have found that supervisors can

achieve a solid safety culture when they display appropriate safety leadership skills while communicating with their crew members.

In addition, Zohar (1980) pointed out that in the oil and gas industry, as in other industries, individuals' functionality is influenced by their knowledge, skills, and motivation to do their jobs. While the employers provide the required knowledge and skills to do the job through training and simulation to all workers, depending on their competence, the crew supervisors provide the motivation to encourage workers to be proactive and to behave safely on the worksite.

1.1.2 Main issues in the oil and gas industry

There are two important issues that the oil and gas industry has faced in the last decades: an ageing workforce, and a workforce with a low level of formal schooling. For example, the workforce average age in the UK oil and gas industry is between 43-55 years old (Hopkins, 2008). Hopkins suggested that the industry will, therefore, face in the coming decade a skill crisis because of retirements, leading the industry to a shortage of experienced workers. Moreover, the entire workforce that was trained in the 1960s and 1970s are approaching retirement. It takes, on average, three years to replace the retirees by a new generation who needs more training to become familiar with the industry and then about another decade to gain a professional discipline that is currently held by experienced workers (Hopkins, 2008). This need for replacement creates a skills problem, while at the same time the global demand for skills and for skilled workers is also increasing. To replace the retiring generation, the industry needs to train another highly skilled generation to meet the increased demands for particular and specialized skills (Hopkins, 2008; Peek et al., 2008). By approaching the 21st century, this

employee age issue, with its consequential lack of new highly skilled staff, creates a recruiting problem for hiring the skilled staff that the oil and gas industry needs. Quite a number of engineers, technicians, and operators are available and are ready to start working on site, but a qualified, experienced workforce is in short supply (Hopkins, 2008; Peek et al., 2008). This loss of experienced personnel to retirement, along with a skills shortage, could seriously affect operational leadership and a company's ability to understand market changes that could lead the industry to unwanted consequences (Hopkins, 2008; Peek et al., 2008).

The need for more education is the second issue that the oil and gas industry has faced in the last decades. In this industry, upwards of 40% of operational leaders have less than a high school level of education, and have no formal knowledge of leadership and communication (O'Dea & Flin, 2001). Gordon (1998) indicated that the majority of accidents in the oil and gas industry tend to occur because of lack of education, experience, and skills among workers. Hence, poor management and leadership, combined with the low level of education among crew members, lead to more conflicts and misunderstandings over directions and assignments. For instance, Piper Alpha disaster that occurred in July 1988 is still regarded as the worst offshore oil disaster in the history of the UK. The accident killed 165 out of 220 crew members. The accident, as many other accidents, was attributed mainly to human error. Gordon (1998) stated that the main cause for the Piper Alpha was "communication failure between the day shift crew and night shift crew, where the day shift crew failed to pass on some information regarding the replacement of a pressure safety valve with a blind flange to retain an appropriate fluid weight" (p.99). Different levels of education between crew members play an important role, especially when they exchange ideas and information, discuss problems, and receive instructions from

leaders; the smaller this difference, the less confusion or misunderstanding there is (Flin, et al., 1998). Lack of education among drilling personnel introduces recruiting challenges to oil and gas companies regarding finding skilled and experienced staff among those who apply for work (Hopkins, 2008; Peek et al., 2008).

According to Hopkins (2008), the oil and gas industry will likely grow by 55% between 2005 and 2030, and it will continue to be a powerful and cost-effective sector into the foreseeable future. This growth attracts a new, young generation due to the current industry boom and great salaries. However, he believed that the industry will face a major crisis as a result of the lack of required job skills among its workforce. In particular, with the increased demand for skills, the risk of a crisis is increasing. More significantly, Hopkins (2008) found that the industry's primary barrier behind many major and minor accidents is the weak relationship between engineers, rig mangers, supervisors, and their crew members. He also clarified that leaders focus their main concern on the implementation of the work task, and they neglect their roles as mentors and role models to new, young staff. An ageing, less experienced and largely unskilled workforce, combined with a poor image of leadership associated with lack of communication and management skills, are the major cause for all disasters that have happened and continue to occur. Clearly the industry must take steps to investigate these causes.

Undoubtedly, some of the leaders in the oil and gas industry have a low level of education and few safety leadership skills. However, at present, the industry accepts their hard work and ethics as the only criteria to be a leader (O'Dea & Flin, 2001; Flin & Yule, 2004). Nevertheless, Hopkins (2008) emphasized that all personnel in the oil and gas industry need four competencies to master their work tasks: "knowledge and understanding, application to practice,

leadership and management skills, and interpersonal skills abilities" (p. 29). In spite of that, 52% of oil and gas employees enter the industry without any prior work experience. It is not surprising, therefore, that they struggle to deal with pressure of work, time management, and professional behaviour and attitude (Hopkins, 2008).

As a result, the oil and gas industry must open other doors to increase the qualifications of its staff. In particular, many companies in the industry offer internal short training courses to develop personnel skills at managerial and technical levels (Hopkins, 2008). To bridge the gap between leaders and their followers more specifically, the industry recognizes training institutions and schools as a formal source of skills improvement for crew members. Most importantly, dealing with educational gaps by providing intensive training will enable all crew members to construct a safe atmosphere and a highly productive work environment. In order to achieve that, the training program must fit in with all the new working methods and techniques the industry has recently experienced. In the case of the global oil and gas industry, shared facilities, equipment, staff, and services are increasing, requiring standardizing the rules, procedures, system, work practices, and training programs. This need for standardization has become a priority concern so that equity and clarity may be achieved throughout the industry (O`Dea & Flin, 2001).

Due to the circumstances mentioned above, the global oil and gas industry and exploration, production committees, international energy, and resources transactions committees have created international standards that all leaders have to achieve through training in order to master their roles and to avoid different kind of accidents and incidents, both major and minor (Karish & Siokos, 2004). They also allowed the training to be taken in the local language of the

employees to ensure that they benefit from the training (IADC WellCAP Handbook for Accreditation, 2012). In case of rigs that are operated by multicultural employees, English is the official language. The rig must also provide interpretation services for non-English speakers (Levy, et al., 2005). For that reason, most oil and gas companies have required their crew members to hold specific certifications and qualifications to be able to work on local or international rig site for the past three decades. The companies also arrange training sessions for their personnel, such as drilling well control, drilling process, leadership and communication skills, as well as safety training. These sessions provide the essential knowledge and skills that trainees, in their respective fields, must have to perform their roles safely.

Equally important, many onshore and offshore rig managers believe that the cause of most of the accidents is not always a technical failure. They occur, according to O`Dea & Flin (2001), because of lack in non-technical issues such as safety leadership and communication skills, as well as stress, depression, and drug use. They pointed out that these areas need to receive as much attention as technical issues. The issue of safety leadership with technical knowledge in relation to the safety climate in the oil and gas industry has been for some time a subject of new research projects. Similarly, Petersen et al. (1961) suggested focusing more training on supervisors, as they are the key element in accident prevention, and also to assist them to set the goals, objectives, and priorities to prepare them to lead their teams. They further recommended that each supervisor should have ongoing, comprehensive, and appropriate training or experience in the area for which he or she is responsible.

Training institutions which have begun to fill the gap in education in the oil and gas industry need to prepare and to train its leaders to perform their job with more consideration to

safety and productivity. There are plenty of training courses that the training industry now provides to oil and gas personnel. Some of these training courses are reputable but they are not accredited by a credible or official organization or international alliance. However, other training programs are solidly grounded in terms of all the basic principles and philosophies of education, and are delivered by trained accredited educators, as well. It is important to establish a common safety understanding for all supervisors, drillers, and other operators. Therefore, there is a need to create a unified training program that aims to improve safety leadership skills through developing the required technical applied skills that both supervisors and their team members need in order to ensure safety on the worksite (Johnsen et al., 2005). The differences in education, experience, and familiarity with the work environment are essential reasons encouraging the industry to provide standardized training in a comprehensible language for trainees to ensure that they understand their tasks and responsibilities.

1.1.3 The implementation of safety standards during drilling operations

At the present time the oil and gas industry faces numerous challenges to implementing a safety culture. However, two main factors challenge such implementation, especially on the international drilling sites. First, the new generation in the workforce comes to the industry with a higher level of education than their leaders. Second, the integration of foreign workers into this industry has resulted in an increasingly diverse work environment (Gordon, 1998). For example, 20 different nationalities are represented by the workers on the rigs that are operated by the Qatar Drilling Team (Levy et al., 2005). This diversity has created a language barrier, and an increasing challenge for any form of standardized safety or training activities. Although English is the official language on rig sites whenever foreign workers apply, it is also a second language

for many workers, causing a lack of direct communication between individuals who are working together on the oil rigs. Therefore, interpreters and translators are required for all rigs that have multinational workers to facilitate communication. In order to standardize the industry, all required training is conducted in English. Attendees for whom English is their second language should have a minimum of low to intermediate level of English competency. However, the training could be conducted in English with use of interpreter to translate the body of the training to the local language of the trainees (IADC WellCAP Handbook for Accreditation, 2012). Nevertheless, the international oil and gas industry recognizes the language issue and its relation to safety and productivity. Therefore, the industry overcomes the language barrier by allowing the required training to be taken in the local language of the employees; otherwise the industry will lose their employees for the sake of language barrier (IADC WellCAP Handbook for Accreditation, 2012). For example, Arabian Drilling Company delivers their training into both English and Arabic because most of their employees are native speakers of Arabic (Arabdrill).

These two factors create gaps between low-educated leaders and their crew members regardless of whether or not they are local or foreign, or low or well-educated workers (Flin, 1997). To bridge these gaps, the oil and gas industry recognizes the potential of training institutions and schools as a formal source for improving applied and leadership skills. Dealing with educational and language gaps between the leaders and their crew members will, it is believed, enable them to construct a safer atmosphere and a more productive work environment. Such training sessions are designed to change behaviour to improve safety on one hand, and productivity and work outcomes on the other hand. Thus, if any industry in the world could clearly benefit from standardized safety and leadership training, it would be the drilling industry.

Hence, focus on training will, in principle, support the increasingly complex role of oil rig leaders and supervisors.

1.2 The Research Problem

In the 21st century, the oil and gas industry is facing great technical challenges, especially with wells being drilled both onshore and offshore, where most oil and gas disasters happen (Hopkins, 2008). These technical challenges have required the industry and its personnel to adopt and develop new technology, and methods, and to develop new skills that enhance or address concerns about safety, protect the environment and/or the likelihood of any damage to it. Therefore, the industry has spent millions of dollars on training to improve its leaders' skills, regardless of whether they are technical or non-technical skills. The critical necessity for this type of training grows with the increased demand for achieving safety in the workplace, and especially with the increased risk of accidents in the onshore and offshore drilling industry. These individuals function as crews or teams working together divided between the day shift and night shift, and they need regulations in place to ensure that the accident risk is kept to a minimum (Sneddon et al., 2006).

This kind of work environment can only improve through work standards based on an effective information exchange system. In addition, it has been proven that safety leadership is a fundamental skill for effective team performance (Hawkins, 1987). Research has shown that crews which perform well are led by supervisors who appreciate and respect the value of each member of their crew, and who develop good interpersonal relationships with the crew members and motivate them to perform their tasks completely (Chidester et al., 1991; Helmreich et al., 1990).

Recent experiences have emphasized the oil and gas industry's need to develop their personnel safety and leadership skills. For example, British Petroleum (BP) focuses on improving safety leadership skills because they play a significant role in changing behaviour and improving productive and safe performance by enabling workers to demonstrate required competencies at work (Kaish & Siokos, 2004). According to O'Dea and Flin (2001), these skills are based on an extensive knowledge and experience of managers and supervisors which allows them to manage people and to create a solid safety climate. Wu et al. (2007) defined these skills as, "the process of interaction between leaders and followers, through which leaders can exert their influence on followers to achieve organizational safety goals under the circumstances of organizational and individual factors" (p. 124).

In 2003 both British Petroleum (BP) and Shell agreed to improve safety leadership skills and performance among safety leaders who are involved in well engineering and drilling operations (Werngren, et al., 2005). They sponsored a program that was titled "Advanced Safety Leadership'' (ASL) to improve personnel safety behaviour and communication skills in order to develop safety leadership skills as a requirement to be a safety leader (Werngren, et al., 2005). This program started in December 2003 in Aberdeen, Scotland and builds on the fundamentals of leading for safety (Werngren, et al., 2005). In terms of the importance of leader safety behaviour and how it affects team members and how unsafe acts of a leader might impact safe performance of all team members, BP and Shell recognized gaps in safety leadership knowledge and skills among well drilling leaders (Werngren, et al., 2005). Leaders need to develop a better understanding of their accountability as safety leaders. This understanding must go beyond their moral and legal obligations and must also consider safety as a personal behaviour. It also

requires leaders to express their commitment to safety consistently in their actions, not only in words (Werngren, et al., 2005).

In addition, the United States' Occupational Safety Leadership & Health Administration (OSHA) (1996) stated that safety leadership skills encourage teamwork and increase the efficiency of team members and the responsibilities for safety performance. Moreover, Lu & Yang (2009) indicated that effective safety leadership is the key factor to reduce human errors and widen safety awareness throughout team members. Many studies (such as Shannon et al., 1997; Hale & Hovden, 1998; Flin et al., 2000; Guldenmud, 2000) highlighted that safety leadership skills are known as managerial behaviour that are consistently related to safety performance. Particularly, when leaders delegate some of their power and responsibilities to team members and allow them to share their ideas to develop safety policy, principles, and procedures. As a result, workforce will take ownership and responsibility for safety (O'Dea & Flin, 2001). Leaders have influence on safety in the day-to-day performance of the workforce. This influence can have a greater impact when leaders treat safety as a personal standard, behaviour, attitude, value, and competency (Werngren et al., 2005).

According to Werngren, et al. (2005), accomplished drilling members are expected to have the safety leadership knowledge and skills in the following areas:

- Awareness of tools, equipment, procedures, standards, and policy,
- Adequate risk information and set clear safety expectations,
- Awareness of responsibility, accountability, and discipline,
- Skills of a successful leader such as: communication and motivation (p.3).

1.3 Purpose of the Study

The first purposes of this study is to identify how training schools implement International Well Control Forum (IWCF) Rotary Drilling Well Control training program to respond to the global need to improve safety leadership skills of crew members in the oil and gas industry in general, and the well drilling industry in particular. This identification is based on IWCF training objectives (IWCF Accredited Centre Manual, 2008: p. 69-71): (a) "to raise crew awareness and enhance the knowledge of human factors that can cause incidents related to safety or production; (b) to develop applied and non-technical skills and attitudes; (c) to integrate IWCF knowledge, skills, and attitudes into current work practices". The second purpose of this study is to identify the main difficulties the trainees face during the training that might challenge their abilities to pass this challenging training. The identification of these difficulties provided a rich description of how IWCF training can develop safety leadership skills. This development was built on deep understanding of the technical aspects of crew members' roles and by accurately responding to the simulation test where the candidate confronts critical drilling situations that require a quick, cautious response based on good safety leadership and communication skills with other crew members to ensure safety and prevent accidents.

1.4 Significance of the Study

The research embodied in this dissertation is significant because it is the first academic study in the oil and gas industry that has addressed the impact of the International Well Control Forum (IWCF) Rotary Drilling Well Control Certification Program, as a worldwide drilling well control program, on developing safety leadership skills among onshore and offshore drilling crews. This study is one of the first studies that has responded to the recommendations of the Oil

and Gas Producers (OGP) report No. 476 (2012) to enhance well control training, examination and certification processes. Therefore, this study is an effort to present a detailed picture of the potential role for safety leadership skills in managing the risk involved in the drilling activities. Furthermore, attempts to answer the following future questions:

- How could IWCF Rotary Drilling Well Control certification program construct the industry goals in terms of upgrading the competence level of its personnel?
- How could IWCF Rotary Drilling Well Control certification program standardize global well control procedures?
- How could IWCF Rotary Drilling Well Control certification program help the industry fill the gap that left by the retirement of experts?
- How could the new levels of IWCF Rotary Drilling Well Control certification improve well control preparedness?

1.5 Research Questions:

The study explored the relationship between International Well Control Forum (IWCF) Rotary Drilling Well Control program and developing safety leadership skills between onshore and offshore crews. The overall research question that the study was based on is ‘What is the relationship among IWCF Rotary Drilling Well Control training and developing safety leadership skills among onshore and offshore drilling crews?’

Consequently, the overarching questions that framed this study were as follows:

1. How does the selected training school design, facilitate, and deliver IWCF Rotary Drilling Well Control training?

1.1. What are the participants' perceptions about IWCF program with respect to the quality of its providers?

1.2. Which module of the three IWCF training modules: the practical assessment (PA) or the equipment (EQ) or the principles and procedures (P&P) module, can actually develop the competence level of the trainees?

1.3. What are the participants' perspectives with reference to the importance of IWCF certification to their career?

2. How well does IWCF Rotary Drilling Well Control training develop safety culture among onshore and offshore drilling personnel?

2.1. What is the definition of safety leadership skills from drilling personnel perceptions?

2.2. How well do technical training programs as IWCF Rotary Drilling Well Control develop safety leadership skills?

2.3. What is the relationship between years of international or local experience and building safety leadership skills?

3. What are the main obstacles the drilling personnel face that affect their performance and productivity?

3.1. What are the main obstacles the trainees experience while they are taking this training?

3.2. What are the main work barriers that prevent drilling personnel from mastering their leadership roles on rig sites?

1.6 Assumptions

1. Focused training and certification enable drilling personnel to acquire and develop knowledge and skills.

2. IWCF training aims at developing a highly skilled workforce to compete in the global oil and gas industry.
3. Technical skills and command skills (leadership, communication, decision making, teamwork, etc.) are needed to perform effectively under pressure to manage hazardous, unexpected events.
4. Although safety leadership skills are imperative skills for effective team performance, poor supervision is a cause of many accidents.

1.7 Definitions of Terms

For the purpose of this study, the following terms are defined:

1.7.1 IWCF Rotary Drilling Well Control Certification Program (Level 3&4)

IWCF Rotary Drilling Well Control is an accredited training course designed to meet the requirements of the International Well Control Forum (IWCF) and is aimed at personnel who are involved in well control critical positions on onshore and offshore drilling operations (IWCF Accredited Centre Manual, 2008).

1.7.2 Safety leadership skills

The current study has implemented Wu et al.'s (2007) definition of safety leadership skills as ''the process of interaction between leaders and followers, through which leaders can exert their influence on followers to achieve organizational safety goals under the circumstances of organizational and individual factors." (P. 124)

1.7.3 Onshore drilling operations

Onshore drilling operations are defined as intensive oil or natural gas exploration drilling activities that happen on land.

1.7.4 Offshore drilling operations

Offshore drilling operations are defined as intensive oil or natural gas exploration drilling activates that happen in deep water.

1.8 Limitations:

The study was limited to the following allocations:

- Participants who attended IWCF Rotary Drilling Well Control training program at driller (or level 3) and supervisor (or level 4) levels at International Oilfield Training Solutions Ltd. (IOTS) in Calgary and St, John's centres, regardless of their job position or level of education. For example, the participants might be assistant driller, driller, rig manager, field superintendent, OIM, engineer, or sea section leader.
- Participants who are Canadian citizens or Canadian residents and English is their native language.

1.9 Chapter Summary

This chapter began by briefly introducing the research problem that focusses on investigating the impact of IWCF Rotary Drilling Well Control certification program on developing safety leadership skills among onshore and offshore crews. This chapter also introduces the significance of the study, research questions, limitations, and definition of research terms.

1.10 Organization of the Study

The remainder of this study is presented in the following manner. Chapter Two focuses on presenting the previous studies that support the importance of developing safety culture throughout using technical or applied training. Chapter Three describes the research methodology involving a qualitative case study design, the process of data collection, and methods of analysis. Chapter Four discusses the themes and sub-themes that emerged from the analysis of qualitative data and presents the findings that answer the research questions that were developed to examine the relationship between IWCF Rotary Drilling Well Control training and improving safety leadership skills. Chapter Five summarizes and concludes this study and provides recommendations for further research.

Chapter Two: **A Review of the Literature**

2.1 Introduction

For this review I investigated studies focusing on the topic of improving safety through training in the oil and gas sector. This review is meant to shed some light on technical and non-technical training programs such as management, communication, leadership, and safety. Moreover, how these training programs can develop safety performance and safety leadership skills among onshore and offshore crew members on well drilling sites in the oil and gas industry. The selection of literature topics that were reviewed frames my understanding of the role of safety and applied training programs in general, and the International Well Control Forum (IWCF) Rotary Drilling Well Control program in particular. Therefore, there are two perspectives found in the literature that informed my research: (1) the impact of applied and non-technical training on developing safety performance; (2) the importance of improving safety leadership skills. This review will help interpret the analyzed data and hence answer the overarching research question: "What is the relationship between technical training and developing safety leadership skills among onshore and offshore drilling crews?" To conclude this chapter I provide a brief description of the theoretical framework of the study.

2.2 The Impact of Applied and Non-Technical Training on Developing Safety Performance

The key aspects of this perspective describe the links between professional training programs and their impact on developing safety performance among oil and gas personnel. These training programs were designated to enhance participants' ability to handle the challenges in their daily work.

2.2.1 Applied training programs

Schubert's doctoral dissertation (1999) aimed to develop riserless\mudlift drilling procedures course to be added to well control training programs to be offered to the members of the Marine Riserless Drilling Joint Industry Project (MRDJIP). The objective of this course was to provide beneficial and practical training in all major well control perspectives with emphasis on mudlift drilling and unusual well control situations that may be arise throughout drilling oil and gas wells. The course was intended to be taught at Texas A&M University's Harold Vance Department of Petroleum Engineering. It was designed to meet the criteria established by the Federal Regulations of Well Control and Production Safety Training in the United States and to exceed the minimum training requirements spelled out by the U.S. Minerals Management Service and International Association of Drilling Contractors (IADC) WellCAP program. It was taught over five days by using varied teaching methods such as lectures and discussion as well as simulator exercises. The simulator exercises were conducted through dividing the candidates into crews to be evaluated on their performance on all jobs carried out on the rig floor. Additionally, the candidates were evaluated on written exercises and exams. A candidate must achieve 70% as the minimum pass for both written exam and simulator practices. A notification letter was sent to the successful candidates. The analysis of conducting well control training indicated that since the drill string safety valves (DSSVs) are used to prevent blowouts up the drillpipe when unexpected subsurface pressures are encountered, they might cause some complications to well control procedures. Moreover, the Subsea Accumulator (SAC) is very necessary piece of equipment that needs to be developed for use in riserless\mudlift drilling. Due to the differences between conventional riser drilling and mudlift drilling, well control training will be necessary

for all personnel involved. Schubert's dissertation findings emphasized the importance of developing well control training programs and upgrading well control simulator software.

Hodgson and Hassard (2006) claimed that simulators have an effective role to reduce crew's learning curve. Simulators have been used for well control training such as IWCF and IADC. They are also used to train crews to efficiently operate new equipment and practice techniques such as Through Tubing Rotary Drilling (TTRD). Hodgson and Hassard also suggested that simulators software can be used to define and observe roles and responsibilities, communication links and competency in a safe environment. Hence, any gaps and weaknesses in performance and understanding can be addressed before the actual drilling operations commences. The simulators practices were programmed to reflect rig configuration and associated with all the relevant well information and issues similar to real life situations. Hodgson and Hassard concluded that such simulator training can provide an ideal opportunity to test the comprehension of communication among crew members and develop emergency plans in safe environment.

Rogers, et al., (2007) discussed another project that has been introduced to the industry by Texas A&M University, Noble Technology Services and the Houston Advanced Research Center. They have formed an Integrated Petroleum Environmental Development program that is supported by a growing team of partners from the industry namely: Anadarko Petroleum Corporation, BP, Shell, ConocoPhillips, Chevron, Derrick Equipment, Halliburton, M-I Swaco, National Oilwell Varco, Statoil, and Huisman-US. The goal of the project was to integrate current and new technology into a drilling system to incorporate engineering and environmental knowledge specifically to reduce the harm impact of oil and gas activities on the environment

especially environmentally sensitive areas. The project addressed four disciplines: transportation equipment and methods, drilling equipment and methods, production completion systems, and studies related to environmental management in oil and gas explorations and their impacts on the environment. The system was tested while drilling one of the first gas exploration wells in Alaska during 2003-2004. Implementing this system helped to (a) define the best available technology for sustainable drilling in specific areas, (b) demonstrate that technology is sufficiently available to economically develop oil and gas resources while protecting the environment, (c) encourage sustainable access to environmentally sensitive areas that are currently restricted for hydrocarbon operations, (d) transfer lessons learned from offshore platforms to other sensitive onshore environments. This project provided an opportunity to the government, industry and academia to cooperate to develop technologies and strategies to improve the industry's environmental management. Even though the oil and gas industry attempted to satisfy global energy demands while being environmentally friendly, the industry must control and manage productions, protect livelihood, internalize environmental costs, and be transparent and open in communication and decision-making processes.

Kropla et al, (2008) presented the role played by the International Association of Drilling Contractors (IADC) Drilling Well Control Program (WellCAP) training program in creating well control culture in the oil and gas industry, particularly in the critical areas of well control. The Well Control Accreditation Program (WellCAP) operated by the International Association of Drilling Contractors (IADC) is designated to provide well control training at the introductory level that provides basic well control knowledge for floorhands, derrick workers and office personnel. The fundamental and supervisory levels address practical well control skills for

assistant drillers, drillers, toolpushers, superintendents and drilling workers. Creating well control culture requires establishing necessary training standards and accredited programs that monitor training provider performance to ensure proper skills development through fit-for-purpose training. Thus this type of training will supply the industry with competent personnel who are capable of recognizing, avoiding and justifying well control situations.

Li, et al., (2012) presented the importance of constructing the practical teaching base of Petroleum Engineering in China to improve the level of training provided to field engineering and technical personnel to improve their professional ability and skills. Moreover, it was designed to fit the requirements and needs of oil companies for recruiting purposes. The study emphasized the need for international engineering education, as well as the need for development of international well control training such as IADC and IWCF certifications. They believed that constructing practical teaching will benefit the oil and gas industry on many levels: (a) it could provide better applied and technical training tasks, and (b) it will locate the training business into oil and gas explorations technology, well control processing and health, safety, and environment (HSE) management. Given that, strong communication and cooperation could be built between school and oil and gas companies.

Finally, Blaauw's master thesis (2012) discussed a number of blowouts and well incidents that happened around the world such as: Ekoisk, Saga, Snorre, Montara, Deepwater Horizon, Gulfaks, Elgin. The study conducted surveys to justify the impact of the technical, operational, and organizational barriers as the main factors that affect and control the well integrity on the Norwegian Continental Shelf. Blaauw listed a number of challenges including accessibility and understanding of regulations and standards, technical implementation, lack of

sufficient training, and low level of personnel competency. Blaauw claimed that the oil and gas industry must standardize the regulations and principles of drilling operations instead of each country having its own regulations. Diverse regulations and standards in regards to well integrity would lead to inconsistencies with regards to safety within the industry. The study recommended the creation of well integrity department within each oil company and the hiring expertise who are knowledgeable of towards well integrity. Another significant recommendation was towards the use of real-time operations or "Integrated Operations" that should help the industry to increase efficiency and reduce cost. By applying these recommendations, the suggested well integrity will continue to grow throughout the industry in the coming years, as well as the knowledge and competence of both global and national personnel.

2.2.2 Non-technical training programs

Burt and Stibbs (1991) clarified the relationship between qualified workforce shortage, development of personnel, and the safety of people and environment. They focused on the current training and development programs used to develop drilling expertise operations either onshore or offshore. Their study found that the drilling industry achieved greater success through developing their crews' skills by using a bottom up training approach, because it is more effective than hiring new or mid-career senior staff. They suggested that this success is due to the training and development a company provides to its existing personnel who become well-trained and equipped, rather than the hiring of staff who need intensive training and familiarization with the system. Burt and Stibbs (1991) shed light on the need for training of rig crew members in the drilling industry, especially with the limitations of the promotability of staff without advanced educational levels such as some drillers. They also stressed that the drilling industry must (a)

impose mandatory training as an essential requirement to work on either onshore and offshore rigs, and (b) supply the staff with all the skills they need to develop their performance as drilling rig members. Moreover, they suggested that the drilling industry should create training plans with identification of individuals' training requirements, as well as create a training system that allows senior contractors to master all technological developments.

Mearns and Flin (1995) reviewed a number of psychological studies of offshore workers on the UK and the Norwegian installations and discussed how the work environment and socio-organizational factors can affect risk perception and attitudes to safety, and risk taking behavior and accident involvement within offshore personnel. Due to the Piper Alpha disaster, the UK offshore installations regulations now require operators to submit formal safety assessment or "safety cases" for all offshore installations. The regulation states specifically that quantitative risk assessment (QRA) must be used in the preparation of safety cases and operators have to be able to identify major hazards and evaluate the risks arising from these hazards using calculations based on the frequency and magnitude of hazardous events. In addition, these studies emphasized the role of knowledge and experience in identifying the potential danger on offshore installations. However, the reviewed studies have shown that onshore and offshore management and the personnel may not necessarily be sharing the same attitudes towards risk and safety and their influences on employees' behaviors. The conclusion of this review has pointed out that employees in the UK and the Norwegian offshore oil and gas industries are generally aware of the risks they are running at their workplace and their perceptions and attitudes to safety are fairly accurate. The review suggested that better understanding of the

different cultures that operate and exist within or between different installations may give a broad perspective on personnel's opinions and attitudes to safety.

Furthermore, Cox and Cheyne (2000) described UK Health and Safety Executive Project that aimed to develop the methodology of safety assessment that based on organisational culture. They discussed a series of studies that focused on the practical needs of offshore managers and workers for the monitoring of safety culture through the development of a self-assessment tool. A combination of assessment methods, such as questionnaires, focus group interviews, behavioural observations and situational audits were used to describe and explore the efficacy of health and safety management systems in offshore oil and gas industry. They also discussed assessment methods that had been piloted within collaborating organisations, both within the UK and the Gulf of Mexico using the "Safety Climate Assessment Toolkit" which was used by managers and safety officers within the offshore oil extraction industry. Cox and Cheyne (2000) summarized the main benefits of using the toolkit as: (1) raising the profile of health and safety; (2) discussing sensitive safety issues and cooperatively working on resolving them; and (3) facilitating evaluation of the current system, both internally and externally. They also indicated that the toolkit will be the subject of further evaluation through its use in the offshore oil extraction industry. Therefore, the organizations that used the toolkit may need to customise the tools presented in the toolkit or develop in-house instruments that they feel are important for their circumstances.

Mearns, Flin, & O`Connor (2001) likewise outlined the value of Crew Resources Management (CRM) training to improve the safety culture in the oil and gas industry through teaching relevant skills such as communication, leadership, teamwork, personal limitations, and

decision making. The CRM program is a training program established in the aviation industry and designed to reduce human error and increase safety. The CRM training aimed to break down the barriers that may exist among team leaders and team members, allowing them to work together in a more positive work environment based on understanding the perspectives of individuals, on sharing information that helps to complete the task, and on removing any tension that could arise and cause an accident. The study concluded that CRM plays an essential role in improving risk communication techniques that have an influence on the quality of decision-making processes and the reliability of good team performance. Furthermore, the study emphasized that CRM has the potential to provide a common and international safety culture that the oil and gas industry might adopt to prevent any miscommunications between team members that might cause accidents.

In addition, O`Connor and Flin (2003) designed, implemented, and evaluated offshore training based on Crew Resources Management (CRM) training. The CRM course covers six major topics: teamwork, leadership, situation awareness, communication, decision making, and personal limitations. The study sample consisted of 77 participants from three North Sea offshore oil and gas companies. They were given a questionnaire and asked to answer it on a scale from 1 'very poor' to 5 'excellent.' They were also asked to give their feedback about whether the course package was interesting, informative or relevant to their job. The results strongly indicated the effectiveness of CRM training in developing positive satisfaction among participants towards this kind of training. Participants pointed out that the skills they learned from CRM training were strongly related to their job description and they would apply them in their workplace.

Crichton (2005) has measured current attitudes toward teamwork, leadership, and stress among drilling team members in the oil industry. The study focused on human and organisational factors that might influence safe and effective performance. Crichton claimed that to develop crew members' attitudes to teamwork, leadership, and stress, the industry must provide focus training to their employees in those areas. He used Flin, et al, (2003) web-based questionnaire version of the Operating Room Management Attitudes Questionnaire (ORMAQ) in order to identify individuals' current attitudes to teamwork, leadership and stress and how these attitudes have changed after training. The study results that related to the leadership component showed that 97% of respondents agreed that team leaders should encourage members, especially less experienced ones, to ask questions during operations. 60% of respondents agreed that team members know and understand each other's responsibilities, while 42% disagreed that any team success is because of the team leader's technical proficiency.

Crichton, Lauche, & Flin (2005) also investigated the effectiveness of Incident Management Team (IMT) training in developing the command skills which are required by drilling members, namely, decision making, situation awareness, communication, leadership, and team work. IMT training has been used in the oil and gas industry in order to educate staff employed in the industry to avoid disasters, such as the Gulf of Mexico incident. The UK structure for dealing with emergency situations consists of three levels:

> (1) strategic leader: involves multiple roles, takes a longer view of the incident, and develops work plans, (2) tactical leader: has coordinating role, determines the tactics required to deal with the incident, and operates on the basis of information received, (3) operational leader: leads the team, makes decisions, and makes risk assessment (p.117).

Six tactical level-leaders and one strategic-level leader participated in this training and were interviewed by the researchers by using a semi-structured interview technique based on cognitive task analysis to identify the command skills required to deal with incidents. The results of this study highlighted the importance of having these command skills in managing accidents for team leaders, combined with knowledge and understanding of processes and procedures to use in case of potential accidents.

Hopkins's paper (2011) described the main lessons that the industry must learn from the Gulf of Mexico oil well blowout. The paper examined a British Petroleum (BP) and Transocean senior managers VIPs visit made to the Deepwater Horizon rig just few hours before the explosion. It argued that even though the importance of safety was the main focus for the senior managers' visit, they paid superficial attention to the major critical activities that were occurring at the time. The paper seeks to answer the following questions: What were these visitors doing? Where was their attention focused? How might their visit have had positive outcomes? Hopkins believed that the answers of these questions must be lesson for all personnel involved in hazard activities. The VIPs were focused on informal safety auditing procedures and asking the employees some safety questions to ensure their understanding of safety culture. At the time of visitors' arrival, the rig staff were engaged in reducing the pressure test. They ultimately misinterpreted the results of their testing and concluded that the well was secure when in fact it was flowing. One of the Transocean senior managers was aware of the issue but he carried on the visit schedule by transferring the responsibility to an on-site rig manager. None of the senior managers have realized that no effective monitoring was taking place. The VIPs were following a scheduled tour so it was easier for them to audit conditions, not actual actions, at the site. Their

visit carried out a policy where not to disrupt drilling activities and not to examine closely what people were doing because that would interfere with the authority of rig managers. Consequently, this paper highlighted the lack of competence level of those who were engaged in the pressure testing. The study suggested that to achieve effective safety auditing, auditors must be aware of the major accident events and ways of control that were supposed to be in place to prevent such event. In addition, auditors must verify whether lessons from previous occupational safety incidents on other rigs had been learnt and transferred. Hopkins outlined that managing-by-walking around is not an effective way to audit safety, and therefore auditors must talk to employees because they are the ones who know what might be going wrong since some auditors are not expert drillers.

On the same subject of Macondo Well Deepwater Horizon, the Macondo Joint Investigation Team (2011) had released their final report where they blamed equally British Petroleum (BP), Transocean, and Halliburton. BP, as the designated operator, was responsible for conducting operations, the safety and protection of personnel, equipment, natural resources, and the environment. Transocean, as the owner of the Deepwater Horizon, was responsible for conducting safe operations and protection of personnel onboard. Halliburton, as a contractor to BP, was responsible for conducting the cement job and monitoring the well. The report determined that the reason for the Macondo Deepwater Horizon disaster was a failure of a cement barrier in the production string, even though the BP investigation team have pointed this as the fault of Halliburton because they were responsible for the cementing job, The Bureau of Ocean Energy Management Regulation and Enforcement considered BP as fully responsible for the failure in communication that contributed in turn to the crew's ability to recognize the flow

of hydrocarbons until it was too late to regain control of the well. The report recommended a number of major improvements to reduce the likelihood of such a magnitude event of occurring again: well control techniques, well control training, assessment and testing devices, and blowout preventers (BOPs).

Koshovkin, Latyshev, and Chemov (2012) presented basic requirements by oil companies for new/young engineers who work on designing and development of oil and gas field. The study suggested the most effective methods of interaction among higher education institutions are in the domain of design engineering training. They introduced a practical approach of implementing staff development and training programs. The need for this kind of training has become a priority to overcome the lack of highly-qualified petroleum engineers. The study argued that there is a gap between an employer's requirements for the level of exposures and competencies and graduate engineers' knowledge and skills. They also indicated that many of the representatives of higher education institutions believe that oil companies must only provide financial support, while the university is capable of assuring a high level of education. The study listed three reasons for the lack of young personnel at educational establishments: low salary; unwillingness of the older generation to change and be involved in the development of new training and learning materials, and finally the bureaucratic system. The resistance to change was also deeply rooted because the evaluation of university performance is mainly defined by the quality of prepared reports and documents required for the assessment procedures. To solve this issue, a Russian Company, named JSC "TOMSKNIPIneft" in Western Siberia performs personnel training, proposed to develop the quality of engineering education in Russia through cooperation between entrepreneurs and universities to reduce the impact of

qualified personnel shortages. JSC “TOMSKNIPIneft” stressed that before launching any training or retraining programs, a developer must know the following: what kind of skills and knowledge both employers and employees need, what kind of learning style and materials appeal to them, and how to use their desire to progress up the career ladder to motivate them to study. This cooperation will require a revision of the existing curricula and a modernization of learning materials and teaching styles to prepare engineers to meet new challenges. Moreover, it will reduce the adoption period, which usually extends to up to five years, by young engineers who do not have an adequate practical experience about real industrial problems.

2.3 The Importance of Improving Safety Leadership Skills

The key aspects of this perspective described the importance of developing safety awareness and skills among oil and gas personnel. This is especially time for those who are engaged in dangerous activities such as drilling wells whether onshore or on offshore rigs.

One of the first studies in this field was Rundmo and Ulleberg’s study (1998) where they compared how job stress, physical working conditions, commitment and involvement in safety work, attitudes towards safety and accident prevention among employees on offshore petroleum platforms have changed from 1990 to 1994. A self-completion questionnaire was carried out among personnel on offshore oil installations in the Norwegian part of the North Sea. The sample consisted of eight installations and five companies in 1990 and 12 installations and nine companies in 1994. The results showed that personnel experienced job stress more often in 1990 than in 1994. The physical workload also was greater in 1990 compared to 1994. Likewise, a greater percentage of the respondents were satisfied with the safety performance in 1994 compared to 1990. The personnel evaluated the working conditions as better in 1994 compared

to 1990. The results also indicated that organisational factors and workload have a consequence for the safety status. However, they pointed out that poor management can reduce their interest in improving offshore safety. All of these factors have an impact on risk perception and risk behaviour among the personnel. Moreover, these factors were also associated with negative attitudes towards safety, as well as poor commitment and involvement in safety from both the management and the other employees.

Fleming (1999) replicated the study conducted by Mearns, Flin, Fleming, and Gordon in 1997. He developed the data collection tools and used a bigger sample size. To identify what behaviour supervisors should display to manage safety effectively in the UK offshore oil industry, two questionnaires were used, one for supervisors and one for their followers, and semi-structured interviews were conducted. 1080 questionnaires were sent to supervisory staff and their followers on nine platform installations. The results reported that both supervisors and followers had a positive perception of the safety climate on their installations. Statistically, followers showed very low levels of risk-taking behaviour and high levels of proactive safety behaviour. These followers also pointed out that their supervisors displayed high levels of safety leadership behaviour. The supervisors described themselves as a considerate leader and had a positive safety management attitude and displayed high levels of positive safety leadership behaviour. The results also indicated that there were four major factors of supervisor behaviour. These behaviours included (1) valuing followers, (2) frequent visits of the worksite, (3) group participation in decision making process, and (4) effective safety communication. They all had a significant impact on subordinate's safety behaviour. The findings of this study emphasized the

importance of teamwork and the interpersonal relationship between supervisors and their followers.

On the subject of safety, O`Dea and Flin (2001) also argued that both leadership style and level of experience of offshore installation mangers (OIMs) affect their safety attitudes and behaviour. They also examined the preferred style of leadership: transactional or transformational style among managers to identify best practice in safety leadership. The sample consisted of 314 offshore installation managers from 36 UK organizations who have a wealth of knowledge and experience of safety and leadership. A questionnaire survey using a 5 point Likert type scale and 45 minutes face-to-face discussion were used to collect data. The results of this study demonstrated that there were no significant effects on any of the scales in the questionnaire for OIMs' level of experience in determining leadership style and/or their attitudes to safety. However, the discussion indicated that some of them faced some difficulties in motivating their teams to increase the safety climate at workplace. The findings of this study also proved that improvement still needs to be made in many critical disciplinary areas especially improved personnel competency and their increased their involvement in safety practices to develop safety leadership skills.

Levy, et al., (2005) pointed out that workers participation in offshore drilling operations can be improved through a Safety Behaviour-Based Observation Program and safety leadership training. All drilling crew members in the Qatar Drilling Team must attend safety leadership training that is conducted prior to the mobilization of a new drilling rig. Each worker had to use an observation card to observe others safety behaviour in order to improve their performance rather than to highlight their mistakes. One of the significant benefits of the safety behaviour-

based observation program was to empower each crew member to be a true safety leader. At the end of this program workers learn to accept constructive criticism and be aware of safety procedures. The overall safety attitude of the Qatar Drilling Team has improved five times better than the industry average after attending safety leadership training and using the observation card technique.

Werngren et al. (2005) alternatively described the fundamental reasons for creating and providing Advanced Safety Leadership (ASL) program to all managers and supervisors in oil and gas companies. The ASL training was begun in December 2003 and targeted Shell and BP well engineering managers. The ASL program aimed to build personal safety leadership skills at the level of team leaders and rig supervisors. It consisted of high, interactive participation, follow-up coaching and mentoring, and tools for the long term sustainability of safe behaviour that help reduce accidents. The ASL program was conducted for two days and was comprised of a mixture of teaching methods: lectures, presentations, simulations, and role-play exercises. Over 1100 Shell and BP well engineering candidates, both onshore and offshore, have attended the training with their own managers, team leaders, and supervisors. The participants have reported positive feedback about the program and its ability to enable both managers and supervisors to create a safe environment and climate at the worksite. They also pointed out that the program encourages participants to formulate personal safety standards within a wider company safety framework.

Sneddon, Mearns, and Flin (2006) presented a review of situation awareness (SA) in offshore oil and gas drilling industry indicators in the UK Continental Shelf. The theory of situation awareness (SA) has introduced three levels of SA: perception, comprehension or

information integration, and projection. Informal semi-structured interviews were conducted with the drilling personnel of six oil and gas operator and contractor companies. 17 personnel participated in this study, ten of them were based onshore, and they all had offshore experience that ranged from 5 to 26 years. They occupied varied positions such as health, safety, and environment (HSE) managers, operational managers, well engineering managers, offshore well engineers, installation manager, and safety representative. The participants defined situation awareness as being (a) aware of the situation they are in it; (b) alert for any changing situations; (c) able to react to changing circumstances. They also listed a number of factors that affect a person's awareness. For example, having problems with their family at home, fatigue, stress, working with inexperienced workers, routine tasks, and long shifts. The results obtained from the interviews indicated that changing in an individual's behaviour and lacking in communications were the main indicators of reduced awareness. The participants believed that communicating with individuals and having a discussion are the most effective methods to improve reduced awareness. Likewise, there are four main methods perceived to be excellent for checking awareness on the job: safety talks at the start of the shift and before they begin the job, risk assessment, continual informal assessment, and "pocket" toolbox talk (TBTs). The study suggested that by maintaining crew communication and involvement, distractions and attention lapses might be reduced.

As a result of the discovery of new oil and gas fields off the Brazilian coast, the oil companies operating in Brazil initiated a search for qualified workers to handle the magnitude of the expected labor demand. Cabral, et al., (2010) argued that the lack of seasoned personnel led the oil companies to hire and train beginners to manage high risk activities. Furthermore, to

familiarize new personnel with their position's tasks, the total of lost time incidents in 2007 was higher than the in the previous years. Therefore, Petrobras, as the main Brazilian oil operator, has developed a 'Red Alert Program'. The Red Alert is a safety program where all drilling rig operations stopped for 24 hours to undertake safety, risk protection and management of hazard activities. The Red Alert day started with a video presentation by Petrobras engineering and production (E&P) Director and contractors addressing the main safety issues to the workforce. After that workshops and meetings are held within each rig crew to explain the major drilling activities and the surrounding risks. As a result of conducting the Red Alert Program, the lost time incidents was reduced, personnel behaviour showed high competence, and they learned from their leaders effective techniques towards creating a safer environment.

A significant anthropological master thesis was conducted by Houser (2010) who focused on studying the nature of subculture value systems adopted by drilling rigs workers in Alberta and the social pressures that sustained them. Houser observed workers on five different wells at a drilling rig in Southern Alberta for one summer. During his fieldwork he interviewed 20 rig hands who specialized in drilling relatively shallow wells. The observation aimed to investigate (a) the disconnection between the formal safety policies and undertaken drilling procedures that demonstrated by management authorities and rig hands, and (b) the effectiveness of the existence of informal safety procedures that operate beyond the boundaries of the formal safety protocols. The study findings identified three factors interfered with the interaction of the lived workplace of the rig workers: social selectivity of workers, undefined promotion process mainly based on favoritism of the rig management, and normalization of their own behaviour, discourses and lifestyle. The results also showed that oil workers who worked on Alberta drilling rigs had an

informal workplace safety culture. In addition, workers created their own workplace safety system that had a more significant influence on their behaviour more than any formal and governmental safety system. Part of this informal safety culture is due to the routine drilling activities and to the rig hands' experience, especially; when the rig is contracted it must work continuously in order to be profitable. Rig workers therefore were willing to be blamed and hold the complete responsibility and guilt towards any accident they were part of, especially if they disregarded such warnings. The recruitment process equally was not formal and it is more of a self-selection process. Consequently, the selection pool has been narrowed down by applying few social criteria such as high school education or less, having labor background, dealing with heavy equipment, and looking fit and muscular. To be selected as a rig worker, a candidate must stand harsh work conditions, accept to be shouted at, have agility and proficiency, be alert to potential risks, respond without panic to unexpected events, and separate their family issues from work. The results also proved that the socialization system was primarily based on verbal abuse. Being able to accept this way of communication, the prize was to be treated as a peer and being kept on the job. Houser claimed that high wages attracted more applicants and that would allow the drilling rigs to be selective about who is hired. Thus, he believed that the verbal abuse culture is related to this economic element and the 'live for today' philosophy of the rig workers. Moreover, he pointed out that joking on the job site has two significant functions: first, to reinforce a level of comfort and stability in the job; second, to soften the harsh nature of the drilling rig work culture. He placed emphasis on the fact that drilling rig workers in Alberta put up with the massive work challenges just for money. Houser recommended further research to

study role-behaviour switching aspect where rig workers manage two incompatible roles: rig life and home life.

Skogdalen, et al., (2011) presented the importance of developing safety indicators for preventing offshore drilling blowouts in the Norwegian oil and gas industry. The study had two main objectives: (1) to assess the safety indicators in the Risk Level Project in Norway (RNNP) and determine their significance as early warnings for oil and gas blowouts, and (2) to discuss possible areas for extensions related to well integrity and thus how to prevent blowouts. The study defined safety indicators as "means for measuring the changes over time in the level of safety related to major accident prevention, preparedness and response" (p.1188). In 1999 the Petroleum Safety Authority in Norway (PSA) initiated the Risk Level Project to (a) monitor safety in the oil and gas industry by using different statistical, engineering and social science methods, and (b) create reliable decision making process towards safety and emergency planning. There were several challenges that affected the offshore drilling sector, such as high cost, complex activities, high pressures and temperatures, and a shortage of seasoned personnel. Therefore, a mutual agreement was put in place among the parties involved in the oil and gas industry that safety culture, drilling operations, technical conditions, and pressure incidents influence each other. Due to this agreement, the study suggested that these influences can be monitored by combining different methods of risk management, such as risk analysis, safety indictors monitoring and investigating of pressure incidents, revision, and inspections. They stated that these methods may help identify, assess, and prioritize the potential risks. One of the significant recommendations of this study was the need to develop safety skills related to operations within offshore drilling.

In a doctoral dissertation focussing specifically on safety culture, Henson (2013) asked how, given all the latest technology and safer equipment, the rig hands still get hurt. Although, working offshore is safe compared to many industries, the study suggested how to make it even safer. Undoubtedly, offshore drilling activities are challenging; therefore it is crucial to differentiate between safe and dangerous procedures that would contribute to creating a culture of safety. The study results suggested that rig management and oil operators should be provided a formula for safe and successful drilling operations. This formula will accordingly help rig leaders to create a safe work environment and higher performance. The results also presented a consistent relationship between rig leaders' performance and preventing both minor and major incidents. This relationship must be built on an understanding of the consequences of potential danger and on how to provide positive insights of safety instructions to their rig hands on the rig board. The results also confirmed that better leadership is an appropriate method for safe performance, rather than punishment except for the intentional breaking of safety regulations. Simple compliments or recognitions by a crew's supervisor are an essential part of a healthy safety culture and the use of observation cards also allowed the crew to make recommendations for safety. Overall, the results proved that the rig crew and management appear to have a shared vision for safety, leadership, two-way communication, employee involvement, a learning culture, and a visible attitude toward accountability.

Finally, Oil and Gas Producers (OGP) Report No. 452 (2013) intends to help oil and gas companies understand the importance of building a safety culture through their own leadership. The report states that building a strong safety culture is influenced by everyone in the organization and their commitments to safety. That means everyone is responsible to identify

unsafe conditions and behaviour. Furthermore, the report indicates that safety culture starts with leadership which in turn drives behaviour. Therefore, senior managers must provide learning and training opportunities to proactively improve employees' skills to become safety leaders. As a safety leader, they must value both production and people and that could be achieved by using different leadership styles namely: transactional, transformational, situational\contextual style. The report adopted Krause's identification (2005) of safety leadership. According to this identification, there are seven major characteristics that describe a safety leader and influence the organization's safety culture. These characteristics are credibility, action orientation, vision, accountability, communication, collaboration, feedback, and recognition. The report defines each of those characteristics and the required skills and behaviour to demonstrate them.

2.4 Commentary on the Previous Studies

By reviewing the previous studies that investigate the effect of some specific training programs on developing safety performance and safety leadership skills, I found gaps in the research that focused on applied drilling technical training programs, such as International Well Control Forum (IWCF) and International Association of Drilling Contractors (IADC), as they are the main mandatory training in the drilling industry. Also, there is a lack of studies that used the above programs to develop interpersonal skills, namely, leadership, communication, teamwork, and decision making. However, the previous literature supported the aim of my research to fill this gap in the literature by focusing on IWCF Rotary Drilling Well Control training and its role in developing safety leadership skills among onshore and offshore crew members. Not only is this study the first study that tackled IWCF Rotary Drilling Well Control training and its effectiveness in developing safety leadership skills among onshore and offshore drilling crew

members, but it also explored the idea of using applied training courses to improve safety leadership skills among drilling crews. Therefore, this research is a much-needed response to recent recommendations of developing well control training, examination and certification and a challenge to their stance by suggesting that IWCF Rotary Drilling Well Control training can be prominent in incident prevention.

Based on the previous literature, the current research investigated whether when oil and gas companies enroll their personnel in skills training, they not only improve those targeted skills, but also encourage continuous improvement in productivity of the workforce by identifying their strengths, weaknesses, and gaps in team competencies. The benefits the industry could potentially gain from putting a financial value on training are enormous. The current study assumed that different types of formal education and training can be positioned to help the development of professionals throughout their career. Furthermore, the increased complexity in drilling processes, technology, procedures, and principles that most national and international drilling companies have experienced, also required an investment in training and development for their staff. As a result, national and international oil companies have invested heavily in developing their personnel's skills through training.

In response to Piper Alpha and Macondo Deepwater Horizon well control incidents, the International Association of Oil and Gas Producers (OGP) have recommended improvements to current well control training, examination and certification process and some of the related philosophies that should be adopted throughout the industry. These recommendations aimed to improve well control knowledge and understanding and the performance of operations teams throughout all types of operations conducted on all wells worldwide. The Well Expert

Committee (WEC) has addressed the current challenges that the oil and gas industry faced in the last three decades. These challenges fall under the following headings:

- Training, competence and human factors,
- International standards,
- Well control incident database, and
- Blowout preventer (BOP) reliability and technology.

According to Van-Vegchel (2008) there are three main obstacles that may affect an individual's participation and thus lower his/her ability to act as a defensive barrier against instability and maintain safety: (1) failure to define the expectations of each team member, (2) role conflict created by duplicating an individual role, and (3) absence of motivation provided by leaders. Due to these factors, he believed that further development of training centres with getting not only national, but also international accreditation of the professional organizations such as the International Association of Drilling Contractors (IADC) and the International Well Control Forum (IWCF). As a result of this development, team members can better tolerate each other, especially the less experienced ones, and do not abandoned them or let them act as the only defensive barrier between team instability and disaster. Once personnel competence and qualification levels are improved, the industrial safety system will be more efficient.

The OGP Report No 476 (2012) recommendations are delimited to well control training syllabuses of IADC and IWCF as the only sufficient and significant well control training programs. According to this report, future well control training should have a strong focus on: barrier management, appropriate and immediate response to hazards, scenario-based well control training, risk awareness, operation types, environment and equipment. OGP report has

introduced five role-based training levels (Figure 2-1) to match specific roles within the operation team. The report has provided a detailed description of each level. International Well Control Forum (IWCF) has adopted these recommendations and implemented the progression system of the new levels starting September 1st, 2014. The main objectives of this implementation are to enhance existing well control training, examination and certification and to be the foundation for a permanent change across the whole oil and gas industry.

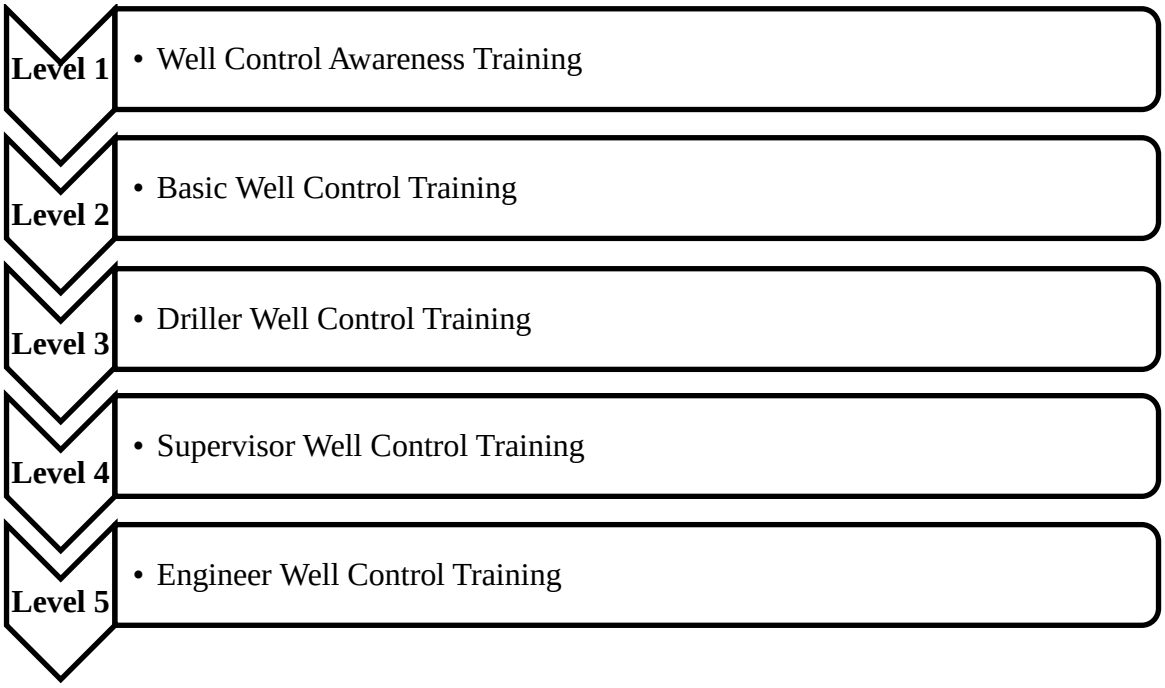


Figure 2.1 Progression through Levels 1-5

2.5 The Theoretical Framework of the Research

Since this research investigates the relationship between IWCF Rotary Drilling Well Control program and safety leadership skills, the framework of this study is built on adult learning theory. IWCF training targets adult learners who gathered a wealth of experience

throughout their onshore or offshore drilling experience. They used this experience as a foundation to understand the new knowledge that they receive from the training. By reviewing the literature that focused on adult learning such as Mezirow, 1981; Merriam, 2001; Merriam, 2008 adult learning theory is based on six principles. According to these principles, adult learners

1. are internally motivated and self-directed,
2. bring life experiences and knowledge to learning experiences,
3. are goal oriented,
4. are relevancy oriented,
5. are practical, and
6. like to be respected.

Mezirow (1997) defines adult learning as "the process of effecting change in a frame of reference" (p. 5). According to Mezirow (1997) a frame of reference consists of assumptions, values, feelings, and reactions that adults construct through their life experience. Moreover, this frame helps adults create "an individual tendency that moves them spontaneously from one specific activity to another" (Mezirow, 1997: p.5). This tendency allows them to fit the new experience in their frame of reference and to reflect on the one that did not fit before they reject it.

Consequently, adult learners such as IWCF candidates learn through four steps (Merriam, 2001). First, they elaborate their existing understanding of well control operations by looking for further evidence to support their point of view. Second, they establish new perspectives and understanding of the knowledge they obtain when they attend IWCF training,

and this establishment is associated with creating meanings of the new knowledge. Third, they transform their point of view because they can understand the differences between the old knowledge and the new one. Therefore, they tolerate to change their ideas and accept the knowledge that IWCF training provides. Hence they make relationships between their frame of reference and the new knowledge. Fourth, they become more aware of the necessity of reflecting on others point of views rather than just reflecting on their own perspectives.

From the above perspective, Kerka (2002) underlines four assumptions of adult learning. First, she claimed that as people mature over life experience they move from being dependent on others to learn toward being independent learners or learner-centered. Second, as they mature, they gather some experience and use it as learning resources. Third, adults are more internally motivated to learn. Finally, they show high interest in learning when the knowledge is related to their life's role. Likewise, MacKeracher (1996) indicates that adults will learn best when:

- others respect and acknowledge them and their past experiences and personal knowledge, skills, values, and motives,
- they are treated in ways which are consistent with their existing description of who they are and what they are capable of doing,
- their learning tolerates some relationship to past experience and can be connected to their existing meanings and personal model of reality,
- they have some sense of where they are going in the learning process, how they will get there, and how they will know when they have succeeded (p.28).

According to Herod (2012) not all adults learning situations involve students who participate willingly. Thus, one factor that greatly influences adult learners is whether the

learning is voluntary or involuntary. If we apply this factor to IWCF candidates, 95% of them are obligated to obtain an IWCF certificate, because it is one of their employment requirements. Therefore, their level of motivation and participation can be fairly justified. There are a number of internal and external factors that influence adult learners' participation and motivation (Herod, 2012). For IWCF candidates the internal factors would be mostly related to one's life goals and personal expectations, while the external factors are related to their work role and responsibility.

In terms of IWCF Rotary Drilling Well Control curriculum content, it offers literacy knowledge and skills that related to well control operations. Its more "theme-based curriculum" involves IWCF standardized syllabus. Each IWCF training provider must frame their curriculum and course materials around relevant topics to IWCF Rotary Drilling Well Control core objectives, knowledge and skills. Since the IWCF curriculum is designed to be taught to personnel at driller and supervisor positions, it targets individuals who have an adequate drilling experience that allows them to achieve IWCF training.

Similarly, IWCF instructors should consider adult learning principles when they teach the course. Also they should allow some opportunity to facilitate transformative learning by encouraging group discussions that help the candidates use their relevant experience to build their knowledge and skills (Barer-Stein & Kompf, 2001).

Likewise, to understand the main leadership styles that drilling personnel use in the workplace, it was important to add a brief description of leadership theory to the theoretical framework. Drilling personnel essentially utilize transformational or/and transactional style(s) of leadership when they lead their crews. Due to the nature of the drilling industry, a transactional

leadership style was dominant. Individuals must follow their leaders and the given instructions to successfully complete the task. The main goal, in this case, is to achieve the company vision by following the policies. Followers cannot rely on their previous experience to perform their current job if their experience interferes with the company policy. However, the development the industry is going through and the new required training have influenced the industry to change the leadership style and allow some flexibility. As a result, transformational leadership style was introduced to the leaders. Some of them implement it and some reject it.

Transformational leadership represents leaders who "stimulate and inspire followers to both achieve extraordinary outcomes and, in the process develop their own leadership capacity" (Bass and Riggio, 2006, p.3). Transformational leaders encourage their followers to develop their full potential and designate their personal ambitions for the good of the organization (Doucet et al., 2009). The transformational leadership is associated with four characteristics: idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration (Doucet et al., 2008). Idealized influence describes leaders who stand as a role model and an example to be followed (Doucet et al., 2008). These leaders deliver a clear and inspiring vision to their followers and motivate them by challenging their abilities and giving purpose to their work (Podsakoff et al., 1990; Doucet et al., 2008). They also encourage their followers' creativity (Avolio, 1999) and value the need of each of their personnel (Doucet et al., 2008). According to Judge and Piccolo (2004) this type of leader acts as a coach and as a mentor for their followers.

On the other hand, transactional leaders provide positive and negative motivation to their followers and trade valued resources by employees in return for professional behaviour and

increased efforts (Podsakoff et al., 1990). The transactional leadership is built on three aspects: "contingent reward, management by exception-active, and management by exception-passive" (Judge and Piccolo, 2004). Contingent reward refers to leaders who communicate with their employees to deliver clear work objectives and who then reward employees when they meet these objectives as a type of recognition (Podsakoff et al., 1990). Transactional leaders use two types of management by active and passive exception dimensions to deal with employees' errors (Doucet et al., 2008). While the active dimension refers to a leader who examines the results of his/her team members misunderstanding and discuss them as soon as they occur (Bass and Riggio, 2006), the passive dimension represents a leader who waits for problems to become serious before correcting the situation (Doucet et al., 2008).

To summarize, the research results will be interpreted from adult learning perspective and transformational-transactional leadership perspective. The goal of learning and attending IWCF Rotary Drilling Well Control training is to create critically reflective personnel who can reflect on their own assumptions and be able to transform them to deal with well control situations. Therefore, IWCF instructors should create opportunities where the candidates can discuss well control issues to validate their understanding and to arrive at a best judgment regarding those issues.

As well, IWCF candidates can integrate the knowledge that they receive through the training to elaborate their leadership style. Nevertheless, choosing between transformational and transactional leadership style depends on many factors, namely the individuals themselves, their employers, and the organization regulations and country legislation.

2.6 Chapter Summary

The literature review on improving safety leadership skills among onshore and offshore crews in the drilling well industry was tackled from two main aspects. These aspects are (1) the impact of applied and non-technical training on developing safety performance and (2) the importance of developing safety leadership in the oil and gas industry. No evidence currently exists that demonstrates how IWCF Rotary Drilling Well Control training program can develop safety leadership skills. Therefore, this study will provide new research, as of yet uncovered in the literature, describing the link between applied training and increasing the competence level among onshore and offshore drilling crews through developing safety leadership skills in order to prevent or reduce well control incidents. Then a brief description of the theoretical framework of the research was provided.

Chapter Three: **RESEARCH METHODOLOGY**

3.1 Introduction

The primary aim of this study was to investigate the relationship between the International Well Control Forum (IWCF) Rotary Drilling Well Control Training Program and developing safety leadership skills. In order to achieve this aim, a qualitative method was used to answer the research questions and to determine whether there is a relationship between technical training such as IWCF training, and developing safety leadership skills among onshore and offshore crews.

The key purpose of this chapter is to briefly describe the research design and outline the steps taken in creating this research study. This chapter first presents the research design then introduces the researcher and the research site. Next there is a brief description of the data collection approach, followed by the steps taken in designing semi-structured interviews. Afterward, the data analysis approach that was utilized in this research is presented. Finally, there is a description of the research sample including the identification, recruitment, demographics and profiles associated with ethical considerations that were adopted while conducting this research.

3.2 Research Design

3.2.1 The necessity for qualitative method design

This study investigated the relationship between International Well Control Forum (IWCF) Rotary Drilling Well Control Training Program and developing safety leadership skills among onshore and offshore drilling personnel who attended the training at International Oilfield

Training Solutions (IOTS) from April to December 2013. In order to answer the research questions for this investigation, a qualitative method approach was undertaken. My research design was grounded in a case study method. This design was used to gather and analyze data from the participants and their experience in the drilling industry. Using qualitative methods can initiate a discovery of new perspectives from the results, ensure the credibility and enrich the integrity of findings, and provide contextual understanding of the research findings. Therefore, the qualitative method provided me with the opportunity to obtain participants' perceptions and describe the extent to which IWCF training contributes to effectively developing safety leadership skills.

The rationale for this research utilized a qualitative research method approach because it allowed me to better understand on the extent to which IWCF training could have an influence on improving safety leadership skills. In addition, Being aware of (a) the importance of IWCF certification to the candidates' career, (b) the need to pass the exam and obtain the certificate, and (c) the pressure that their employers place on them to pass the exam to keep their jobs, provided me the opportunity to realize how all of the above affect participants' perceptions and their interpretations of IWCF certification's role in their daily job practices.

3.2.2 Qualitative case study

Qualitative case study was well suited for my research because it has the capability to provide data about how IWCF candidates viewed the role played by IWCF training and certification in the oil and gas industry. Since this research considers the first study that tackled IWCF Rotary Drilling Well Control Training Program, I argued that this research could produce a detailed understanding of the importance of technical training programs and their ability to

develop nontechnical skills that individuals need in the oil and gas industry. Consequently, I opted to provide a rich description that can be used as a base for future research. In this study, participants described their experience during IWCF training and how they could integrate the knowledge that they obtained from the training into their level of professional skills.

Merriam (1988) claimed that case study provides rich and complete description of the phenomenon under study. Based on this assertion, I gathered data from onshore and offshore drilling crews who provided details for the construction of well control knowledge that they gained from IWCF training and how they will implement it when they are in well control situations. According to Yin (2003) case study is "an empirical inquiry that investigates a contemporary phenomenon within its real-life context" (p.13). Therefore, choosing case study was applicable because it provided me a deep recognition of the participants' lived experience. It also provided me a deep understanding of the role played by IWCF training in the oil and gas industry. Furthermore, by using qualitative case study I was able to (a) generate a well-grounded and sufficient comprehension of IWCF certification's role in the participants' careers and how it could be used to improve safety leadership skills, (b) get involved in the process of data collection and analysis, and (c) allow me to integrate my experience and knowledge into account to launch descriptive principles of IWCF certification's role and its importance in the onshore and offshore drilling industry.

Another significant reason for selecting qualitative case study is because qualitative interpretations can contribute great meaning to the collected data. Considering Stake's description (1995) of the knowledge obtained by case study, he claimed that this knowledge is

concrete, contextual, developed, and generalized. These four qualities have the ability to define different opinions of IWCF certification program and their influence on the results.

The qualitative case study design was the rationale for my research because it helped me to (a) focus on testing the set of assumptions as well as the circumstances within which the assumptions are believed to be true, and (b) to determine whether IWCF training has an impact on developing safety leadership skills. It also allowed me to comprehend the relationship between variables, and whether this relationship is a straightforward or complex.

On one hand, one of the key benefits of a qualitative case study design is that it allowed me to compare many different variables at the same time and gather the related information. For example, I was able to look at age, years of international experience, type of rig: onshore or offshore experience, course location: Calgary or St. John's, and educational level in relation to passing the exams. This method therefore allowed me to look at four groups of participants who are similar in their need for IWCF certification and share characteristics such as similar job tasks and responsibilities, work for international employers, and background experience. They differ, however in their interests and perceptions of IWCF certification and its impact on their career.

On the other hand, the obtained information from using a case study helped me to develop my understanding about the reasons behind whether the participants acknowledged the importance of IWCF training to their career or not. In addition, it helped me to compare the responses among the four groups and make conceptual frameworks of these responses.

Since this research is the first that studies IWCF Rotary Drilling Well Control Training Program, using a qualitative case study alone was an adequate approach to investigate the impact of this training on developing safety leadership skills and to answer why and how this training

has or has not had an impact. Table 3-1 simply describes the characteristics of the research design:

Table 3-1 The Basic Characteristics of Research Design

Characteristics	Design
Method	Qualitative case study
Typical paradigm foundation	Adult learning theory
Data collection tool	Semi-structured interview
Sampling	Purposive sample
Analysis method	Analytical description

From table 3-1 the research paradigm foundation is based on adult learning theory. Due to the fact that IWCF Rotary Drilling Well Control Training is targeted at people who already have experience in the drilling industry, the candidates can construct the new knowledge upon their prior knowledge. In order to construct their knowledge they seek to make meaningful conceptions and practices. IWCF training is designed to activate the candidates' prior knowledge, introduce new knowledge and provide opportunities to allow each individual to build upon their own knowledge. Therefore, this illustrates that there are differences between seasoned and less-experienced candidates who receive IWCF training.

To sum up, table 3-2 summarizes the research procedures in implementing qualitative case study design.

Table 3-2 Basic Research Procedures in Implementing a Qualitative Case Study

Phases	Procedures
Phase 1	**Design and implement the qualitative case study method** • State the semi-structured interviews questions. • Obtain the ethics board permission. • Identify the research sample. • Conduct the interviews.
Phase 2	**Data analysis** • Creating themes and codes to analyze the qualitative data.
Phase 3	**Interpretation** • Summarize and interpret the qualitative results. • Discuss to what extent the qualitative findings.

3.3 Data Collection Method

3.3.1 Semi-structured interview

Choosing semi-structured interviews as a data collection technique was both sufficient and necessary because I needed to know how the participants interpreted the importance of IWCF certification in the industry and its impact on their career. The 40 semi-structured interviews gave me the opportunity to listen to significant work experience and events that the participants shared with me. It also allowed me to develop a deep understanding of the participants' experiences and perceptions.

By using semi-structured interviews, I began by generating general questions about participants' age, job title, level of education, type of rig: onshore or offshore, and years of local and international experience. I then formulated the interview questions by focusing on specific

areas that allowed me to collect data and answer the research questions. All interviews were conducted in English and audio-taped and transcribed verbatim. The interview questions were flexibly worded. However, some of the questions were highly structured because there was some specific information required from all respondents. I created a list of questions to guide the interview in order to explore the relationship between IWCF training and developing safety leadership skills (Appendix A). Nevertheless, I did not use exact wording or a particular order of questions when I conducted the interviews. This kind of flexibility enabled me to respond accordingly to the situation at hand and gave each respondent an opportunity to describe their opinion about IWCF training.

As a result, 40 candidates who attended IWCF Rotary Drilling Well Control Training at International Oilfield Training Solutions (IOTS) participated in the interviews from the following categories:

- Ten candidates at combined surface and subsea stack/supervisor level and ten candidates at surface stack/supervisor level. They all hold one of the following positions: tool pusher, rig manager, operation manager, drilling manager, field superintendent, operation installation manager (OIM), company man, drilling consultant, drilling engineer, petroleum engineer, geologist or safety officer. Some of combined surface and subsea stack supervisor level hold positions such as ship captain, marine subengineer, or deck supervisor.
- Ten candidates at combined surface and subsea stack/driller level and ten candidates at surface stack/driller level. They all hold one of the following positions: derrickman, roughneck, assistant driller, directional driller or driller.

– 36 of the participants work overseas. Only four participants work locally in Canada for drilling contractor companies that operate some of Shell projects in Alberta or Seadrill projects in St. John's. That is because most international oil companies such as Shell, Seadrill, Chevron, and Husky require each drilling crew member who works at certain positions in relation to drilling operations to have IWCF certificate, even if they operate in Canada where First Line or Second Line certification is the only requirement in order to work on drilling rigs.

3.3.2 Pilot interviews

In order to test my questions, I conducted pilot interviews, and this was crucial to learning about my questions and to determining if 60 minutes would be adequate to cover the interview questions. The pilot interviews prompted the rephrasing of some questions, as well as the addition and omission of other questions used in the train study.

Based on the pilot-interview outcomes, I rephrased and clarified the questions by using clearer words that better reflected the purpose of the questions. There were both hypothetical questions and interpretive questions, where the former describe main well safety issues in order to know how the participants would respond to it as a leader in a similar situation. In turn I used the interpretive questions to explore the participants' opinions about IWCF training and its importance to their career. I avoided multiple and leading questions that might force the respondents to answer in a certain way undermining the integrity of the research. I also avoided yes-no questions because they produce no significant information that would enrich the research. A final review of the interview questions was conducted by posing the questions to myself to

ensure there would be no challenge to understand or answer these questions, and to confirm that these questions were relevant to be asked. The interview questions are contained in Appendix A.

3.3.3 Conducting the interviews

For the semi-structured interviews, I was interested in hearing about the participants' own personal experience and opinions about the IWCF training program that they attended. Also, I was interested in hearing some stories about any critical safety situations they have faced and how they reacted to them.

Each interview lasted for 60 minutes because that is the maximum estimated period of time that IWCF candidates would have during this course. However, in a few cases the conversation was clearly of great interest to the respondents, and they went beyond the appointed time by as much as 30 additional minutes. I took notes during the interviews, but also recorded the interviews to ensure accuracy. Recording the interviews allowed me to engage in the conversation with the respondents and use nonverbal communication forms such as eye-contact and body language to show my interest in the information that they were sharing with me. To answer the research questions, it was crucial to obtain the required information, and therefore occasionally I had to redirect the conversation to answer the interview questions by asking subquestions. All interviews were transcribed verbatim by me.

As it turned out in the interviews, the participants did not ask me about the research design or whether I was using qualitative or quantitative method. Even though the majority were interested in the research idea and they wanted to participate in the interview, they were more concerned about the time limitations and me getting all the information that I needed within the constraints of a 60 minute interview.

3.3.4 The interview guide

I created a final list of questions to use as an interview guide. This guide consisted of specific questions that I intended to ask the participants during the interview (Appendix A). I started the interview by asking basic descriptive questions, and respondents were asked to provide information about:

- their age,
- their job title and responsibilities,
- their level of education,
- the type of rig operations: whether onshore or offshore operation,
- how many years of experience they have in the drilling industry,
- whether they have an international or just local experience,
- previous onshore and offshore experience,
- how many times they have taken IWCF training.

3.3.5 Managing interview data

Another reason the interviews were recorded was to ensure that everything the respondents said could be retained for analysis. In order to analyze the obtained data, I transcribed the interviews verbatim. For the purpose of organizing the interview data, I then created coding schemes. Each piece of interview data was designated a code to facilitate the analysis of the data and write up the research findings. All themes and codes were organized in a table for clear interpretation.

3.4 The Researcher

Having the opportunity to work at International Oilfield Training Solutions (IOTS), and be involved in a number of developments with regards to designing IOTS training programs manuals and course materials including IWCF Rotary Drilling Well Control, provided me the opportunity to be familiar with International Well Control Forum (IWCF) policies and procedures. Furthermore, being a team leader for the Accreditation Department allowed me to gain deep understandings of IWCF accreditation structures (A full description of the implementation of IWCF training is provided in more detail later in this chapter). However, being one of the IOTS team and having direct involvement with IOTS, there was obviously a danger of researcher bias influencing this study. I remained aware of this danger at all times. One concern during the time I was recruiting and interviewing participants was that participants might not feel the need to share all the details or their personal opinions on the raised questions about different aspects of my study. In particular, the questions designed to obtain the participant's perceptions about (a) the importance of IWCF certification, (b) quality of IOTS as an IWCF accredited training provider, (c) the instructor qualifications, and (d) the training materials were of concern. A great deal of time was spent confirming to the participants that all the information they shared with the researcher would only be used for research purposes and they would always remain anonymous.

3.5 Delimitations

When I opted to study the relationship between IWCF training and developing safety leadership skills among onshore and offshore crews, I chose to interview a number of drilling crews who were involved in drilling operations and who attended IWCF training at IOTS. The

majority of the participants were working for international employers where safety is a high priority. These participants had demonstrated positive attitudes and a commitment to share with me their experiences and personal points of view about the importance of IWCF certification to their career. Nevertheless, the findings of this study may not apply to other drilling crews who work on Canadian local rigs, or even to other international drilling crews. However, I believe that the overall perceptions of the selected participants are sufficient to determine whether or not there is a relationship between IWCF training and developing safety leadership skills among onshore and offshore crews or not.

The delimitation of this study focused on investigating the perceptions made by Canadian citizens or residents who work on international rigs and require IWCF certification in order to maintain their jobs. This delimitation allowed me to obtain a focused perspective rather than a wider variety of participants from different ethnic backgrounds and circumstances. Therefore, their perceptions and responses are not necessarily representative of other ethnic groups.

3.6 Research Site

Since my research was focused on defining whether there is a relationship between IWCF training and developing safety leadership skills from IWCF candidates' perspectives, only candidates who attended IWCF Rotary Drilling Well Control Training Program at driller and supervisor levels at International Oilfield Training Solutions (IOTS) were asked to participate in this research. Interviews took a place at IOTS facilities in Calgary and St. John's, Canada. IOTS has three locations in Canada:

- Calgary, Alberta, which was established in August 2009 and is the primary centre,

- St. John's, Newfoundland, which was established in February 2011 and is the secondary centre, and
- Kelowna, British Columbia, which was established in June 2011 and is the third centre.

3.7 International Well Control Forum (IWCF) Rotary Drilling Well Control Training Program

The program is aimed at onshore and offshore drilling personnel who are involved in drilling operations. Candidates are required to complete a training course at an IWCF accredited centre prior to sitting examinations. IOTS conducts the IWCF course which is taught in five days according to the IWCF course syllabus. This duration is adequate to prepare candidates at driller level (or level 3) and supervisor level (or level 4) for examination and assessment, which consist of the three following modules:

– Practical assessment (PA) module by using the drilling simulator.

– Two written tests:

1- The first test covers the drilling equipment (EQ) module. The duration of this exam is one hour for all levels.

2- The second test covers the drilling well control principles and procedures (P&P) module. This test takes one and a half hours for the surface driller level, two hours for the combined surface and subsea driller level, and two and a half hours for all supervisor level candidates. The reason for these varied test durations is because of the number of questions that each level has.

3.7.1 Examination procedures

The IWCF program utilizes separate sets of tests for surface operations and combined surface and subsea operations. IOTS as an accredited centre must nominate the program and level at which each candidate is to be certified, based on the registration form that each candidate must submit to IOTS prior to the course. Only one type of assessment is allowed for each candidate at a certification session. For example, a candidate cannot register to take surface driller level and supervisor level courses at the same time. A period of 10 days must be considered between levels. To obtain a certificate, candidates must achieve a minimum mark of 70% in each module of the test program. The following description identifies the procedures to conduct both the practical assessment and the written tests (IWCF Accredited Centre Manual, 2008).

3.7.1.1 Practical assessment

The assessment is normally conducted in pairs consisting of a driller level and a supervisor level candidate. In case this partnership is not available between the registered candidates, the assessor acts as a driller with the supervisor candidate, or acts as a supervisor with the driller candidate. During the practical assessment one of the following combinations of candidates is acceptable as figure 3-1 presents:

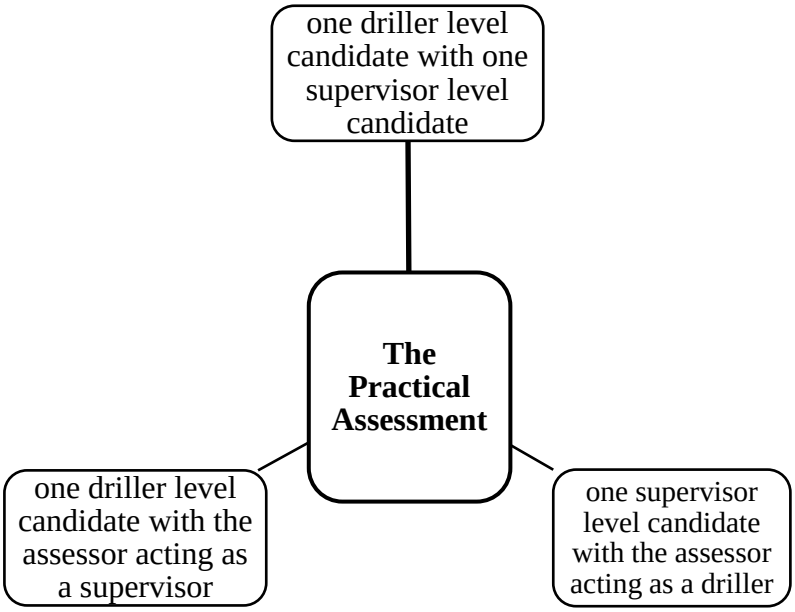


Figure 3.1 The Practical Assessment Combination

Each candidate is required to solve a problem provided by an accredited assessor during the simulator session. In order to solve their problem, the candidate should complete the kill sheet (described below) using one of the drilling methods either Wait & Weight Method (W&W M) or Driller's Method (D's M). W&W M and the D's M are the main drilling methods that must be used when there are accidental miscalculations causing the well to be shut down. Although there are many drilling methods such as Concurrent Method, Volumetric Method, and Reverse Circulation Method, W&W M and D's M are the major drilling methods that most oil companies use to kill the well. The kill sheet that every candidate has to complete is "a printed or a soft form that contains blank spaces for recording certain information about the necessary steps to kill a well" (Baker, 1998: G-7:1). Figure 3-2 is a sample of a subsea kill sheet that combined surface and subsea candidates has

to complete as part of their practical assessment. Kill sheet expertise is one of the main objectives that each IWCF candidate must attain in order to pass the practical assessment and the principles and procedures exam. This exercise consists of many calculations that the candidates have to complete individually and manually, and are required to kill the well. Some candidates have difficulties with this exercise since they do not have to do it manually when they are at work, as they usually use a computer software program to do the kill sheet calculations.

International Well Control Forum

Subsea BOP Vertical Well Kill Sheet (API Field Units)

DATE : _____

NAME : _____

FORMATION STRENGTH DATA:

SURFACE LEAK -OFF PRESSURE FROM FORMATION STRENGTH TEST (A) psi

MUD WEIGHT AT TEST (B) ppg

MAXIMUM ALLOWABLE MUD WEIGHT =

$$(B) + \frac{(A)}{\text{SHOE T.V. DEPTH} \times 0.052} = (C) \text{ ppg}$$

INITIAL MAASP =

((C) - CURRENT MUD WEIGHT) x SHOE T.V. DEPTH x 0.052)

= psi

CURRENT WELL DATA:

SUBSEA BOP DATA:

MARINE RISER LENGTH feet

CHOKELINE LENGTH feet

DRILLING MUD:

WEIGHT ppg

CASING SHOE DATA:

SIZE inch

M. DEPTH feet

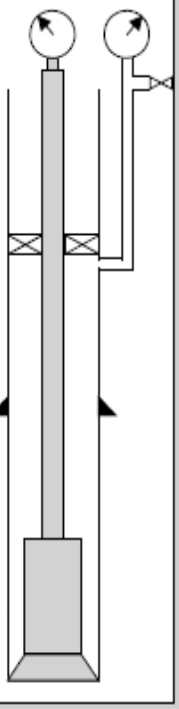
T.V. DEPTH feet

HOLE DATA:

SIZE inch

M. DEPTH feet

T.V. DEPTH feet



PUMP NO. 1 DISPL.	PUMP NO. 2 DISPL.
bbls / stroke	bbls / stroke

	(PL) DYNAMIC PRESSURE LOSS [psi]					
SLOW PUMP RATE DATA:	PUMP NO. 1			PUMP NO. 2		
	Riser	Choke Line	*Choke Line Friction*	Riser	Choke Line	*Choke Line Friction*
SPM						
SPM						

PRE-RECORDED VOLUME DATA:	LENGTH feet	CAPACITY bbls / feet	VOLUME barrels	PUMP STROKES Strokes	TIME Minutes
DRILL PIPE	x	=		VOLUME / PUMP DISPLACEMENT	
HEVI WALL DRILL PIPE	x	=			
DRILL COLLAR	x	=			
DRILL STRING VOLUME			(D) bbls	(E) strokes	Min
DC x OPEN HOLE	x	=			
DP / HWDP x OPEN HOLE	x	=	+		
OPEN HOLE VOLUME			(F) bbls	strokes	Min
DP x CASING	x	=	(G) +	strokes	Min
CHOKELINE	x	=	(H) +	strokes	Min
TOTAL ANNULUS/CHOKELINE VOLUME			(F+G+H) = (I) bbls	strokes	Min
TOTAL WELL SYSTEM VOLUME			(D+I) = (J) bbls	strokes	Min
ACTIVE SURFACE VOLUME			(K) bbls	strokes	
TOTAL ACTIVE FLUID SYSTEM			(J+K) bbls	strokes	
MARINE RISER x DP	x	=	bbls	strokes	

Dr No SSV 04/01
(Field Units)
27-01-2000

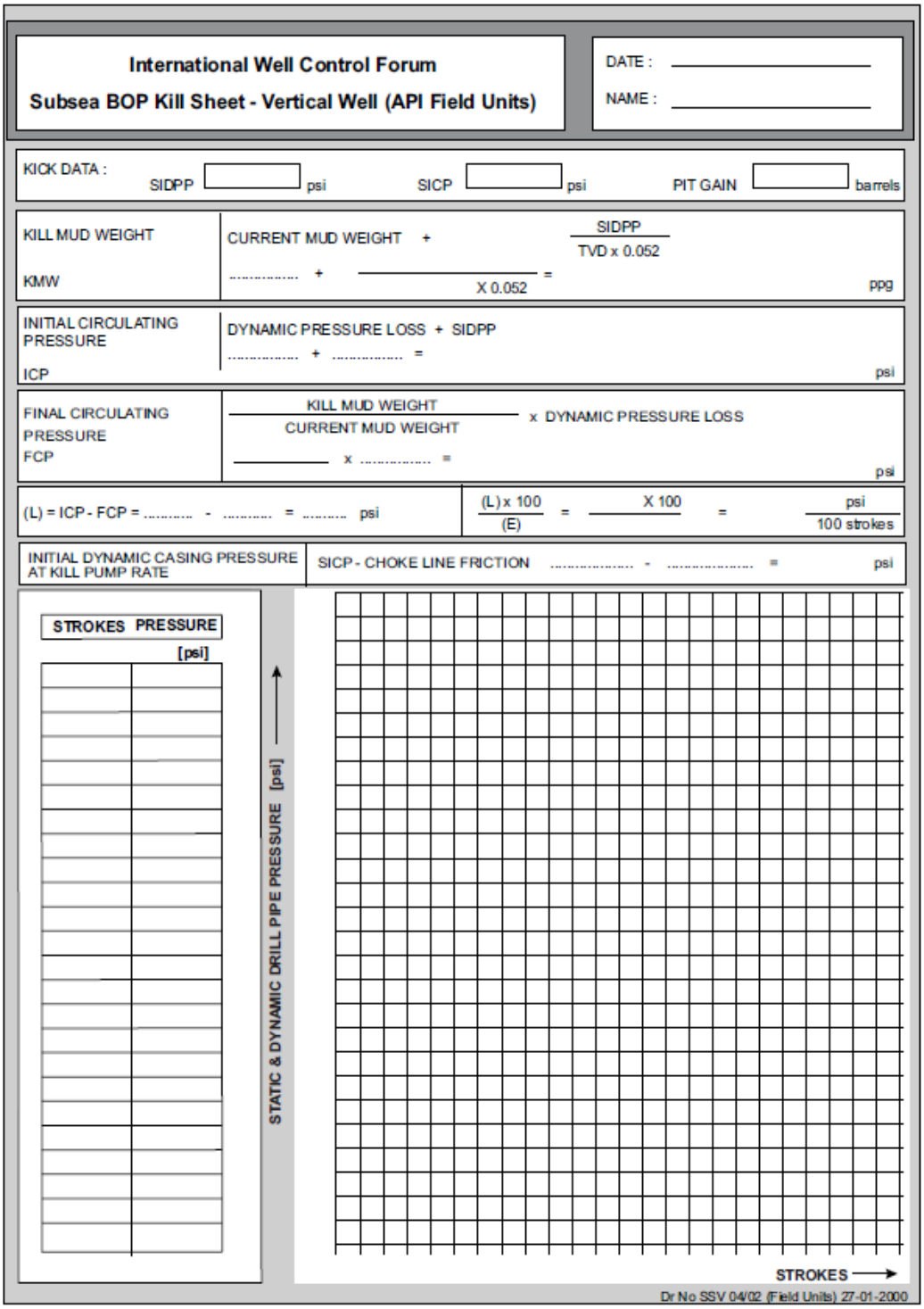


Figure 3.2 A Sample of Kill Sheet (www.iwcf.org)

Candidates at the driller level are assessed according to standard IWCF criteria on their demonstrated ability to (IWCF Practical Assessment Handbook, 2014: p.6-7)

- set up the drill floor for drilling according to instructions,
- set the choke position,
- make appropriate preparation prior to drilling,
- set the alarms,
- recognise drilling break and influx, and take appropriate action within an acceptable time,
- carry out the operation to kill the well under supervisor instructions,
- collect shut-in data, and
- monitor BHP and start the kill procedures.

Whereas candidates at the supervisor level are assessed according to standard IWCF criteria on their demonstrated ability to (IWCF Practical Assessment Handbook, 2014: p.6-7)

- give appropriate instructions to the drillers prior to drilling,
- ensure that the driller is aware of the procedures in place,
- check the alarms settings,
- collect and check data,
- complete the kill sheet and step-down chart,
- bring the pump to kill rate to maintain bottom hole pressure constant in co-ordination with the driller,
- monitor BHP and complete the kill procedures,
- identify one problem during the kill operation and take appropriate action, and

- co-ordinate the shut-down the well with the driller.

3.7.1.2 Written Tests

- *Equipment (EQ)*: each candidate is required to complete a written test that includes multiple choice questions. This test aims to assess the candidates' understanding of the equipment and its components and operating procedures by using diagrams and pictures. All candidates are allowed one hour to complete this section.
- *Principles and Procedures (P&P)*: each candidate is required to complete a written test comprising multiple choice questions and kill sheet calculations. The allotted time to complete this section varies from level to another. Surface driller level (level 3) candidates are allowed one and a half hours, combined surface and subsea driller level (level 3) candidates are allowed two hours, and both level 4 surface and combined surface and subsea candidates are allowed two and a half hours to complete this section. The reason for the different durations is due to the varying number of questions at each level.

3.7.2 Invigilation

Independent invigilators registered and approved by the IWCF conduct the written tests. For example, an invigilator from the University of Calgary conducts the examination sessions at IOTS training centre in Calgary, an independent certified invigilator provides this service for both the St. John's training centre, and the Kelowna training centre. IWCF dispatches the exam materials package for each test session to the appointed invigilator. The invigilator is responsible for checking the exam materials package and comparing them to the test nomination form to ensure that each candidate has the right exam papers. The test invigilator also has to guarantee

the testing materials remain confidential prior to the exam date. On the test date, the invigilator administers the tests and marks them according to the answer keys provided by IWCF.

The invigilator who conducts the exam typically has no previous knowledge of well control and has no relatives or relationship to any of the candidates who are taking the exam at that session date.

In my experience, all IWCF invigilators that conducted the test sessions at IOTS performed their tasks with a high level of professionalism. They understood the pressure and stress the candidates face during the exam, especially when some candidates are too nervous to write the exam, or have difficulties with math or using the calculator. The invigilators are always prepared for these kinds of situations and, as much is possible, they try to provide a comfortable exam atmosphere for all candidates.

3.7.3 Certification

In order to pass the exam, a candidate must achieve a minimum of 70% on each component: Practical Assessment, Equipment, and Principles and Procedures. Upon passing the exam, IOTS will issue a temporary certificate for the successful candidates. This temporary certificate is valid for 90 days. The invigilator is responsible for shipping the original exam materials back to the IWCF head office in Angus, UK with copies of the candidates' registration forms, grading sheets, and all unused exam materials. IOTS has no authority over the exam materials. The invigilator gives the accredited centre the following documents upon completing the exam session:

- original nomination forms after adding the test paper numbers,
- original candidates' registration forms after adding the candidates results,

- original grading sheets and grading analysis sheets for each test paper, and
- a copy of the invigilator claim form.

The accredited centre must send electronic copies of the following documents to the IWCF Certification Department after each test session:

- temporary certificate (if the candidate passed the examinations),
- previous valid certificate to maintain the anniversary date of the certificate if it is applicable,
- original nomination forms after adding the test paper numbers,
- original candidates' registration forms after adding the candidates' test results and signed by the authorized centre manager,
- candidate personal information form (CPIF),
- a colored copy of the practical assessment plot (graph) signed by the practical assessor and the nominated candidate,
- practical assessment grading sheet, and
- completed kill sheet for each candidate from their practical assessment session.

After both the invigilator and the accredited centre have submitted the test documents to the IWCF Certification Department, a technical audit will be conducted by an IWCF certification administrator to ensure the proper delivering of the exam procedures. If the auditing process indicates any changes to the candidate test results, IWCF notifies the accredited centre in writing. Accordingly, the centre must notify the candidate about the changes in their test results.

If the change was from fail to pass, the accredited centre must inform the candidate and issue a temporary certificate to the candidates. If the change was from pass to fail, the centre must inform the candidate that he/she has 90 days to resit the failed component from the initial exam date. Once the candidate decides when he/she wants to rewrite the failed component, the centre must submit the test nomination form to IWCF 10 days prior the desired exam date.

3.7.4 Resit procedures

Unsuccessful candidates are allowed to resit the failed component of the program according to the following IWCF resit criteria (IWCF Resit Criteria & Guidance, 2014):

- the resit must be taken within a period not exceeding 90 days from the date of the initial test session,
- if the candidate failed two or more components at the initial examination they are not eligible for a resit. They must reregister as a new candidate and attend the full course after a waiting period of 28 days,
- if the candidates failed one component at 65% or below, they are not eligible for instant resit. They must receive further training to improve their weaknesses. Evidence of retraining must be submitted to IWCF for approval prior to the resit date,
- if the candidates failed one component at 66% or above, they are eligible for instant resit on the same day or within 90 days from the initial exam date.

The centre where the candidates successfully completed the resit is responsible for issuing the temporary certificate and submitting the test documents to IWCF.

3.8 Selection of Participants

3.8.1 Purposive sampling

The purposive sampling involved designating a group of people who were selected based on their experience and knowledge necessary to my research. Using this sampling approach was imperative because it allowed me to focus on the characteristics of IWCF candidates that are of interest (Tongoco, 2007). Furthermore, purposive sampling was the most appropriate technique for my research, and to determine the relationship between IWCF training and safety leadership skills. Prior to providing the invitation letter, I looked at the registration form that each IWCF candidate had to submit to IOTS in order to be enrolled in IWCF training. Since my research required certain participants, I created a set of criteria requiring candidates to be:

- a surface driller, surface supervisor, combined surface and subsea driller, combined surface and subsea supervisor, ten candidates from each endorsement,
- internationally employed or in Canada for international employers,
- new to IWCF or renewing their IWCF certificate,
- Canadian citizens or residents, and
- Native English speakers.

3.8.2 Ethical considerations

All ethics protocols were followed and an ethics certificate (No. REB13-00035) was granted by the University of Calgary Conjoint Faculties Research Ethics Board (CFREB). I also obtained written permission from the president of International Oilfield Training Solutions (IOTS) that allowed me to meet the potential participants. I met the selected IWCF candidates who attended the training at IOTS in the Calgary and St. John's centres privately at a meeting

room for 30 minutes to provide the invitation letter (Appendix B). The letter invited the selected candidates to participate in a one-on-one interview, described briefly the research study, and expressed the hope and expectations for a lively and mutually beneficial discussion with the participants about their own experience with the IWCF training. This brief meeting allowed me to answer any question the participants might have and to provide more clarification to help them decide whether they would participate in this research or not. For this study, there is a requirement to protect the participants' rights and not force individuals to participate, which holds true for all research where human participants are included in a study (Creswell, 2007). A consent form (Appendix C) was obtained from each participant prior to beginning interviews.

Even though I am an employee of IOTS, I was "at arm's length" and have no authority to enforce IWCF candidates to participate in this study. I had no professional relationship with IWCF candidates that would compromise their freedom to decline participation. I was not involved in any way with their training course, whether with teaching or assessment. Even though IOTS is an IWCF accredited centre that facilitates and provides the training, it does not perform the written examination. IWCF Examination Department dispatches the exam materials package to the University of Calgary when the training session is conducted at the Calgary centre, and to an independent invigilator if the training session is conducted in the St. John's, or Kelowna centres. Then the selected invigilator then performs and marks the exams. Therefore there was undue pressure on the candidates about to whether to participate in this research study or not.

All participants were informed that they could withdraw from participation in this research study at any time they wish without penalty by simply advising the researcher. They

were however informed that data collected to the point of withdrawal would be used upon their participation or withdrawal. No personal information was collected during and after the research, and all participants were assured they would remain anonymous. The only identifiable information that was retained once data collection is completed is as follows:

- age,
- job title and responsibilities,
- level of education,
- years of local and international experience, and
- type of rig (onshore or offshore).

This retention of anonymized demographic information is necessary because it will help future researchers build better understandings of the improvements the drilling industry have made in terms of developing its personnel competence.

3.8.3 Choosing the sample

Identifying participants who met the required criteria for this research imposed some challenges mainly because I sought individuals in small communities, such as well control training facilities where the fieldwork took place. The fact that I worked at a well control training facility represented in International Oilfield Training Solutions (IOTS) made things easier in regards to finding potential participants. I relied on my work experience and involvement in the oil and gas industry to choose them. I nominated the participants who have the knowledge and experience that my research needed, nearly that they have the ability to reflect on their participation in this research and have the time to participate in this study. However, I was not able to evaluate the respondents' participation for the research problem until I completed

collecting the data, and I came across a few instances where the participants did not provide me with enough data to analyze. So, I had to find other participants to replace the previously selected ones to add more depth to the collected data.

3.8.4 Sample size

The sample size was based on IWCF statistics and IOTS statistics regarding the number of IWCF Rotary Drilling Well Control candidates who were enrolled in this program for 2012. IWCF training facilities are new in Canada. Since IWCF certificate is not a mandatory certificate for those who work in Canada, most Canadian well control training facilities instead provide First Line and Second Line certificates because they are the required certificates to work in Canada. New training facilities were established in Canada to provide the internationally recognised certificates such as the International Well Control Forum (IWCF) certificate and the International Association for Drilling Contractors (IADC) certificate for Canadians who work internationally or want to work for an international employer. According to IWCF statistics, the number of Rotary Drilling Well Control candidates who were enrolled at Canadian training facilities in 2012 is 1343 candidates. There are five IWCF accredited training facilities in Canada. All these five facilities have more than one branch in Canada and, of course, some accredited centres have more demand than others.

International Oilfield Training Solutions (IOTS) was established in August 2009. According to IOTS statistics, the number of candidates who enrolled in IWCF training program increased annually between 2009 to 2012 prior to conducting this research (Table: 3-3).

Table 3-3 IOTS Statistics From 2009 to 2012

Year	Number of candidates in each location			
	Calgary	**St. John's**	**Kelowna**	**Total**
2009	0	-	-	**0**
2010	15	-	-	**15**
2011	57	22	11	**90**
2012	71	59	17	**147**
Total	143	81	28	**251**

From the above table, the number of candidates who took IWCF training at IOTS obviously increased from 2009 to 2012, especially at Calgary and St. John's centers. Based on my research objectives and since I do not have any claim about the generalization of any results, I chose ten participants to represent the four categories. Because I wanted to study this subject in depth and I was looking for participants' insight. According to Marshall & Rossman (2010) there is no optimal size for qualitative research. Therefore, ten participants from each category were adequate to hear varied perceptions and to allow me to discover in enough depth what I wanted to know (DePaulo, 2000).

Due to the lack of training requests at the Kelowna facility from April to December 2013, the Kelowna centre was excluded from this research. I actually went to Kelowna twice, once in June 2013 and once in November 2013, but only one candidate out of all seven agreed to participate. Nevertheless, during the interview I realised that the candidate had no previous

experience working on drilling rigs; all his 17 years of experience were spent working on services rigs, which are different from drilling rigs in some aspects. He had decided to take the training because he wanted to work overseas and change his profession from service rigs to drilling rigs. His participation was therefore not adequate to answer the research questions.

As a result for the above description, the study was conducted only in the Calgary and St. John's centres. Nevertheless, conducting the study between the Calgary centre and St. John's centre enabled me to make a balance between the number of onshore and offshore candidates. Since the study compared the differences among four categories of onshore and offshore respondents, I needed ten participants to fill these four categories. Therefore, my estimated sample size was 40 participants. The majority of onshore candidates were registered at the Calgary centre while offshore candidates were registered at the St. John's centre. This is due to the type of the provincial oil and gas industry that operates in Alberta and Newfoundland. However, it was important to know the difference(s) between onshore and offshore candidates' perceptions about IWCF training and its ability to develop safety leadership skills. I chose the participants from each centre equally according to the following description demonstrated in table 3-4.

Table 3-4 The Research Sample Distribution

Endorsement	Calgary	St. John's	Total
Surface\Driller	5	5	10
Surface\Supervisor	5	5	10
Combined Surface & Subsea\Driller	5	5	10
Combined Surface & Subsea\Supervisor	5	5	10
Total	20	20	40

The other factor that determined my sample size was the Canadian demand for IWCF training. The drilling industry in Canada does not require either IWCF or IADC certification for employees to be qualified to work on drilling rigs. Personnel who work on Canadian drilling rigs are required to obtain either First Line Well Control or Second Line Well Control certificate depending on their position whether a driller or a supervisor, which are both mandatory by law to work locally on drilling rigs in Canada, but are not internationally recognised. Yet, all personnel who are involved in drilling operations on any project operated by Shell, Husky, BP, Seadrill in Alberta or Newfoundland must hold IWCF certification regardless of whether they hold First Line or Second Line certification. On the other hand, the majority of drilling personnel who

work internationally must hold either an IWCF ticket or an IADC ticket depending on the oil operators and drilling contractors' requirements.

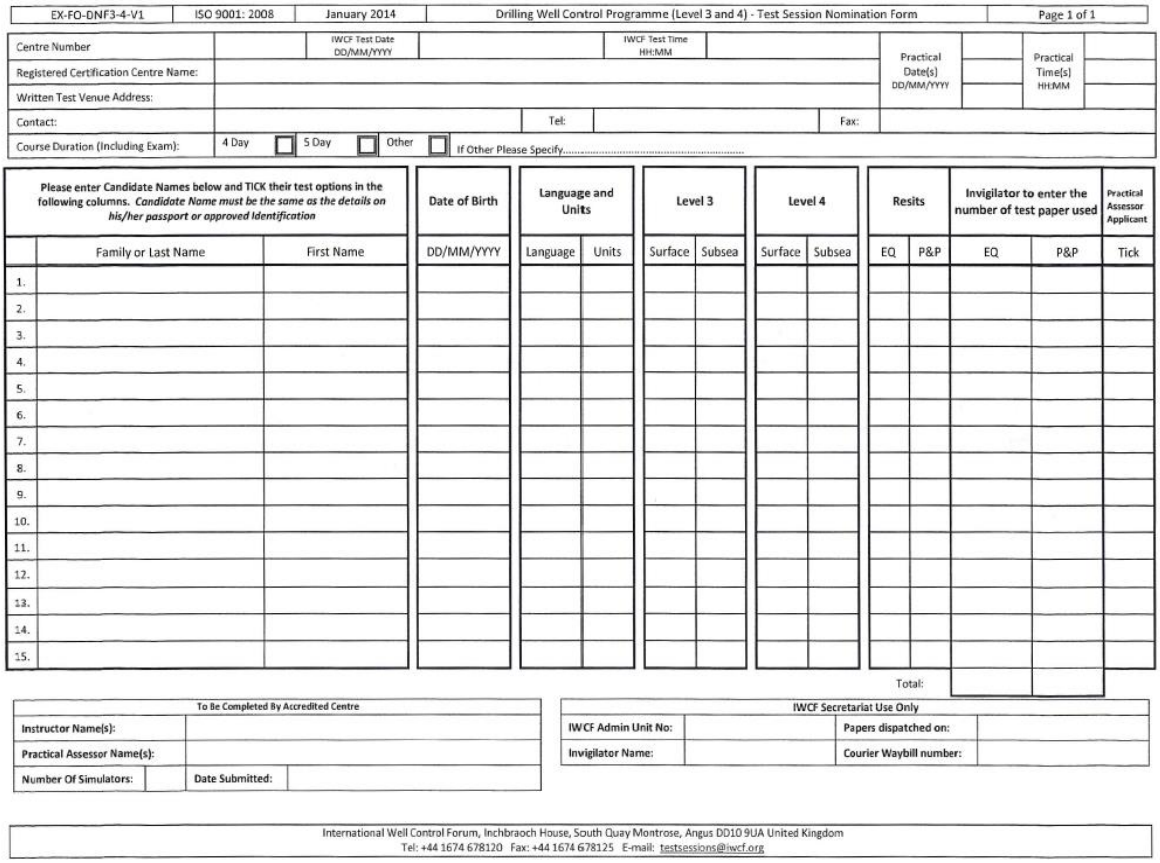
Another significant reason to choose 40 participants was the difference in opinion and attitude towards IWCF certification with reference to being one of the main internationally recognised certificates that must be obtained in order to maintain employment between onshore crews and offshore crews. The differences in their personality influence their attitude toward IWCF training. In fact, these differences allowed me to understand the variety of opinions on how these participants view the importance of IWCF certification to their career.

3.8.5 Acquiring participation for interviews

The participants were selected from those who enrolled at IWCF Rotary Drilling Well Control training at International Oilfield Training Solutions (IOTS). IOTS is an IWCF accredited centre that provides IWCF Rotary Drilling Well Control training for both surface stack and combined surface and subsea stack. The maximum number of candidates that IOTS was accredited for is ten candidates for the Calgary centre and eight candidates for both Kelowna and St. John's centres.

All IWCF candidates have to submit a complete registration form to the IOTS Administration Department in order to submit the Drilling Nomination Form (DNF 3-4 Level) to the Examination Department at IWCF (Figure 3-3). The submission of this form must be done online ten days prior the desired test date. This ten days period is sufficient because it allows IWCF Examination Department to prepare the exam documentation package to be shipped from the UK to Canada and ensure invigilator availability for the test session. The DNF 3-4 Level form consists of the basic information of each candidate such as: name, date of birth, requested

level (driller-level 3, or supervisor-level 4) and surface stack or combined surface and subsea stack, practical assessment date and time, assessor name, instructor name, and centre information: name, location, phone and fax numbers as figure 3-3 illustrates.



EX-FO-DNF3-4-V1	ISO 9001: 2008	January 2014	Drilling Well Control Programme (Level 3 and 4) - Test Session Nomination Form	Page 1 of 1

Centre Number		IWCF Test Date DD/MM/YYYY		IWCF Test Time HH:MM		Practical Date(s) DD/MM/YYYY		Practical Time(s) HH:MM	
Registered Certification Centre Name:									
Written Test Venue Address:									
Contact:			Tel:		Fax:				
Course Duration (Including Exam):	4 Day ☐	5 Day ☐	Other ☐	If Other Please Specify.....					

Please enter Candidate Names below and TICK their test options in the following columns. *Candidate Name must be the same as the details on his/her passport or approved Identification*			Date of Birth	Language and Units		Level 3		Level 4		Resits		Invigilator to enter the number of test paper used		Practical Assessor Applicant
	Family or Last Name	First Name	DD/MM/YYYY	Language	Units	Surface	Subsea	Surface	Subsea	EQ	P&P	EQ	P&P	Tick
1.														
2.														
3.														
4.														
5.														
6.														
7.														
8.														
9.														
10.														
11.														
12.														
13.														
14.														
15.														
										Total:				

To Be Completed By Accredited Centre			
Instructor Name(s):			
Practical Assessor Name(s):			
Number Of Simulators:		Date Submitted:	

IWCF Secretariat Use Only			
IWCF Admin Unit No:		Papers dispatched on:	
Invigilator Name:		Courier Waybill number:	

International Well Control Forum, Inchbraoch House, South Quay Montrose, Angus DD10 9UA United Kingdom
Tel: +44 1674 678120 Fax: +44 1674 678125 E-mail: testsessions@iwcf.org

Figure 3.3 Drilling Nomination Form DNF 3-4 Level (www.iwcf.org)

By using this form, I was able to obtain the sufficient number of participants from the four categories: surface drillers, surface supervisors, combined surface and subsea drillers, and combined surface and subsea supervisors. Making a balance among these four categories was especially important for data collection purposes and to answer the research questions. Hence,

ten days before the training session started, I already had an idea of who could be approached for participation in this research.

3.8.6 Actual response results

A total of one hundred and five of IWCF candidates were contacted by letter and invited to participate in a one-to-one semi-structured interview. 46 candidates accepted the invitation, 43 refused and sixteen never responded. The refusals varied widely, but the some examples were

- "It is very difficult to find time during one week training."
- "I won't be that much of help because I am so stressed since passing this exam will determine my career and my family future."
- "I have nothing to say about this training. It's mandatory training and if it is up to me, I would never take it but it is a job requirement."
- "I left school when I was at grade nine so it will be hard for me to have a discussion at university level."
- "As a drilling engineer I had received several requests from master students to participate in their research and it became very difficult for me to accommodate them even if I have some knowledge of their topic of studies."
- "I have a flight right after the test and I don't want to miss it."

The lack of interest in participation demonstrated in this study could be explained by (a) the shortage of free time that the candidates might have during one week training, (b) the stress that the candidates experience during this course, (c) the belief among some participants that this course is useless, or (d) the lack of desire to be subject of study due to shyness.

The final number of the IWCF candidates who agreed to participate in this study was 46 participants. However, four candidates did not pass the final written test and they left the centre after receiving their marks. The other two candidates declined the interview because they were dissatisfied with their final marks.

3.8.7 The implementation of recruitment procedures

The first day of the training usually starts at 8:00 AM. The program administrator checks the candidates' identification and helps them complete the registration procedures including the candidate personal information form (CPIF). This form must be emailed or faxed to the IWCF head office in Angus on the first day of each training session to confirm candidates' attendance. These procedures usually take 30-45 minutes. Then the instructor takes 30-40 minutes to (a) introduce himself, the course outlines, and the course materials, (b) explain IWCF examination procedures and the requirements for conducting the three components of the examination, (c) inform the candidates about the date and time that they are scheduled to complete the practical assessment, and finally (d) lay out the resit procedures in case the candidate fails one or more components of the IWCF examinations.

This introduction allowed me to meet with one or two of the potential participant(s) individually in the meeting room at IOTS centre. After answering all of the potential participants' questions, I provided the informed consent (Appendix C) to them to read and sign if they agreed to participate in the study before returning it back to me after lunch break. Once I received the signed consent form, I scheduled their interviews to be conducted on the fifth day of training. They had the opportunity to choose the time between 1:00-5:00 PM after they had completed the written tests.

3.9 Validity

Validity in this research "has to do with description and explanation and whether or not the explanation fits the description" (Denzin and Lincoln, 2000: p. 393). I aimed to develop meanings from the collected data and connect them to the literature.

3.10 Generalizability

Generalizability or external validity assesses the degree to which the research findings are generalizable to other situations (Merriam, 2001). In this research the external validity represents the degree to which other well control training programs have an impact on developing safety leadership skills among drilling personnel. It is important to note that the emergent themes in this study only represented the perceptions of ten participants of each of the four job categories: surface driller, surface supervisor, combined surface and subsea driller, and combined surface and subsea supervisor. The findings should not be generalized either to IWCF itself or to any other well control training programs. Nevertheless, it is up to the reader's preference to apply the research findings to other well control training programs that are similar to IWCF and to make a solid framework for comparison (Merriam, 1988).

3.11 Data Analysis

In order to bring meaning to the collected data, I used three stages of data analysis process as suggested by Stake (1995). These stages were classification, interpretation, and description. A brief explanation for these three stages is as follows:

- Classification: the initial stage of my data analysis began while data were being collected. After the completing of each interview, (1) I wrote notes to remind myself of the key themes and the unique examples and quotes as identified by participants, (2) I then transcribed

verbatim the interviews and identified and coded the main themes. This process was both crucial and beneficial because it provided me the opportunity to become more familiar with the data, allocate, and categorize them appropriately. This also allowed me to interpret the meanings of themes as they emerged, (3) to keep track of the themes, I organized the data into categories and subcategories. To do this, I first read the entire interview transcriptions and made some notes and comments on the most important aspects of the data, and (4) I afterward named the categories to reflect what I had obtained from the data and to help me answer the research questions. While ensuring that all relevant data were exclusively placed only in one category. I displayed all the categories and subcategories in a table with purpose statement for each category and subcategory as headings.

- Interpretation: I used an analytic approach to provide opportunities for the reader to make generalizations and understand how these findings might apply to other settings. This approach to interpretation allowed me to develop a professional framework that was based on participants' perceptions about the impact of well control training programs in general, and IWCF Rotary Drilling Well Control Training Program in particular, and how they develop safety leadership skills. This approach also allowed me to compare the similarities and differences in opinions and perceptions among the four groups of participants.
- Description: by using the emergent themes from the collected data, I was able to develop a heightened understanding of the participants' perceptions. This understanding allowed me to describe these perceptions to determine whether there is a relationship between technical training such as IWCF Rotary Drilling Well Control and developing safety leadership skills or not.

3.12 Chapter Summary

This chapter outlined the research design undertaken and provided a brief description of the data collection method. A description of research site was then provided, and sampling techniques and size were described, and then data analysis steps were outlined. The following chapter comprises an in-depth description and interpretation of the themes and patterns that emerged from this analysis.

Chapter Four: **THE ANALYSIS AND INTERPRETATION OF THE RESEARCH FINDINGS**

4.1 Introduction

The purpose of this study is to examine the impact of International Well Control Forum (IWCF) Rotary Drilling Well Control Training Program on developing safety leadership skills among onshore and offshore crews. In this chapter, I present the findings to the overarching research question: "What is the relationship between technical training such as IWCF training and developing safety leadership skills among onshore and offshore crews"? I interpret the data that I collected by presenting the main themes and sub-themes that emerged from the analysis of qualitative data. To answer the overarching research question, I interviewed 40 candidates who attended IWCF training at International Oilfield Training Solutions (IOTS) from April to December 2013. Semi-structured interviews were conducted to collect the data. The interviewees were from four sample groups: surface driller, surface supervisor, combined surface and subsea driller, and combined surface and subsea supervisor. The analysis process started with transcribing the interviews, coding the transcribed responses, and identifying the main themes to compare the sample groups. Eight main themes, along with their sub-themes, eventually emerged from the interview data. These themes are as follows:

- The quality of IWCF provider,
- IWCF program modules and the level of competence,
- The importance of IWCF certification in the candidates' career,
- The definition of safety leadership skills,
- Applied training and safety leadership skills,

- Experience and developing safety leadership skills,
- Training obstacles,
- Work barriers and building safety leadership skills.

In this chapter, I will present the results and the analysis of each of these eight themes followed by an interpretation to help the reader understand their relationships from the different perspectives of the participants on each of the main themes.

4.2 The Quality of IWCF Provider

Findings related to this theme are based on how each participant evaluates the quality of International Oilfield Training Solutions Ltd. (IOTS) as an accredited centre with regards to how IOTS facilitates and delivers IWCF Rotary Drilling Well Control Training. This theme is directly related to the subquestion: "What are the participants' perceptions about IWCF program with respect to the quality of its provider?" The findings of this theme are presented from three aspects: the instructor, the course materials, and the facility.

4.2.1 Instructor

This research took a place at IOTS, which is one of the IWCF accredited training providers in Canada. The primary centre of IOTS is located in Calgary, Alberta. IOTS also has two secondary training centres. One is located in St. John's, Newfoundland and the other one is located in Kelowna, British Columbia. The research was conducted in both the Calgary and St. John's centres.

I conducted my research between April 2013 and December 2013, and during this period IOTS had only one IWCF accredited instructor and assessor. In order to be an IWCF instructor, a

candidate must meet one of the following pre-accreditation criteria (IWCF Accredited Center Manual, 2008):

- Field experience in the industry in a supervisory role for at least two years, in a role which required a current IWCF driller level (level 3) or supervisor level (level 4) certificate.
- A Bachelor of Science degree in a relevant subject such as Petroleum Engineering, Drilling Engineering, or Geology, or a Bachelor of Education qualification.
- A relevant vocational qualification, for example, the Norwegian system of vocational training and education.

Applicant instructor must hold a current IWCF certification in the highest-level program for which the applicant instructor intends to instruct. For example, if the applicant candidate intends to teach level 3 (driller level) and level 4 (supervisor level), the candidate must hold surface or combined surface and subsea certificate at supervisory level (level4). In addition, the applicant candidate must achieve 90% or above on the three components: practical assessment, equipment, and principles and procedures.

In this section, I will use the pseudonym "Mr. James" to refer to the instructor to ensure anonymity. Mr. James has 35 years of experience working in the drilling industry. He started as a leasehand before progressing to roughneck, assistant driller, driller, rig manager, drilling supervisor, field superintendent, and drilling consultant. He left school at age 17 and went to work in the drilling industry in the 70s. Even though he had no previous experience, he was qualified to work on the rig site. The fact that he grew up on a farm was satisfactory evidence that he was accustomed to physically demanding work and could deal with heavy equipment,

which were the primary requirements for working on a drilling rig at that time. At age 21 he worked on the Foothills rigs which, at the time, were considered one of the most difficult drilling rigs because of the nature of Foothills region. He then went on to work with a Canadian drilling company for about 17 years, holding different positions from driller to field superintendent. In the 90s Mr. James went to work for international employers in different part of the world: the United States, the Middle East, and China. He then worked for a Canadian training facility as a First Line and Second Line instructor. After that, he became a drilling consultant and he still provides some consultations for international oil companies and drilling contractors. As a drilling consultant, he was required to have an IWCF certificate at the combined surface and subsea supervisor level. In August 2009, Mr. James established IOTS and he became an IWCF accredited instructor and assessor.

As shown above, Mr. James has remarkable varied experience in the drilling industry. Undoubtedly, he meets and exceeds IWCF instructor criteria, and is an IWCF accredited instructor and assessor. Mr. James has to renew his IWCF certificate every two years in order to continue instructing IWCF training program. The following discussion of the instructor aspect of the findings will only be about Mr. James, as he was the only IWCF instructor and assessor at IOTS during conducting this research study.

All participants from both surface level and combined surface and subsea endorsements indicate that Mr. James is very qualified instructor, because he is knowledgeable and explains each point using simple details in order to make it easy to understand and absorb. He does not rush the students through any exercise, and he takes the time to explain the concept many times and in different ways until he ensures that every candidate understands it. Furthermore, he

simplifies things and uses examples such as movies scenes, jokes, and TV shows just to bring it down to the most basic accessible level.

Equally important, Mr. James's long experience in the drilling industry has a great impact on the candidates. They trust his experience, and the fact that he teaches the well control course without following an instruction book or reading from a PowerPoint presentation increases their level of trust. Because he comes from the same field, he has a unique way of connecting his teaching to the candidates' work experience. According to a respondent at the surface supervisor level, "everything I need to know to pass the exam, plus what I need to know for my own personal game in the industry, I can learn it from Mr. James." He knows the Canadian rig personnel mentality, and therefore he uses the rig terms rather than long complicated terms that may be hard to understand or remember for some of the course participants especially those who have limited formal education. Also, his voice is "crystal clear" and there was no language barrier as in other training facilities. He helps each individual, especially the ones who struggle with math and calculation assignments; he walks them through the steps of how to use the calculator to do even simple calculations. For example, one of the surface drillers recalled his difficulties with math, saying "math is something that has never come easy to me, right from the time I was in school education, but Mr. James knows how to make math simple to somebody like me who has a tough time with it."

In addition, he has a social, friendly personality, and he is a good communicator who full of enthusiasm which makes everyone comfortable throughout this difficult course. He uses his sense of humor to help the stressed candidates relax and enjoy the training. Two of combined surface and subsea supervisors describe Mr. James as follows: "he teaches well control in very

serious but also funny way, he didn't cram whole piece of paper down to my throat without giving me a lot of sugar or some water to soften it up" and, "it was actually the best course I ever had in my mind and so much fun." He also emphasizes the differences between what IWCF expects from the candidates when they answer the test questions and what happens in real life situations. Therefore, he lays out all the directions to help them pass the test by showing them how to obtain the correct answers, preventing possible exam failure in case they choose to use their experience to answer the test questions.

Similarly, he is aware of the importance of the IWCF certification to each individual; therefore, his main goal is that each candidate leaves the centre with a certificate so they can go back to work. Even though he is trying to help all candidates to go through the training program and pass the test, he cannot push anyone who is not ready to write the test and he always reminds them that, "you can lead a horse to water but you can't make it drink."

One of the main attributes that all candidates agreed on is that Mr. James does not give up when the candidates do not understand certain subjects, and that he has the ability to switch between three or four different methods until the subject is understood. He comprises a mixture of teaching methods: lecture, presentation, group dissection, and simulation. He has the skills to read each candidate and recognise their weaknesses. One of the combined surface and subsea drillers described him to be "very quick to realize if somebody is not getting it. He either picks up on body language or the blank stare." To achieve this goal, Mr. James starts the class with basic information to know the candidates' levels and abilities, and then he manages his teaching speed based on these levels. If he has one candidate who needs extra time to complete the calculations, he gives them the time that they need and keeps checking on them until they

complete the exercise. For those types of candidates, he offers one-on-one tutoring after the class, where they can ask any questions without feeling embarrassed about taking up the class time.

For the purpose of satisfying the candidates who work internationally and those who work on local rigs, the class is usually conducted in two units: American Petroleum Institute (API) and Canadian metric *Système Internationale* or International System (SI). For those who work internationally, for example in the United States, Middle East, and Brazil, they usually use the API unit. Whereas the ones who work in Canada they are familiar with SI unit. However, if all registered candidates for that training session request the same unit, the instructor then uses the one specified.

From my work experience with Mr. James, I would describe him just as the candidates did. He dedicates his full time to the candidates. Sometimes, he stays at the centre until midnight to help one candidate who is struggling with calculations or completing the kill sheet. The first day of the class he writes his cellphone number on the board and informs the candidates that they can call him whenever they have any difficulties or if they are confused while they do their homework. He never complains about the many phone calls that he receives especially on Thursday night when the candidates prepare for Friday's test.

He understands the value and importance of the IWCF certification to the candidates' career. Therefore, he attempts to reduce the level of stress and test anxiety that many candidates face during the training. Even if he has a flight on the test day, he calls the centre many times above all to wish them good luck but also to check on some candidates by name or to remind some of them to follow certain steps when they complete the kill sheet.

Mr. James teaches well control with passion and a high level of confidence in his knowledge and experience. Even though he teaches this course every week, all year-round, I never seen him complaining or bored. He is always full of excitement and energy. One of the combined surface and subsea supervisors states that, "Mr. James is very qualified, very thorough, very knowledgeable, and I can just tell in a way how he speaks about the equipment, the procedures, and the policies."

From a practical perspective, Mr. James is the president and owner of IOTS. Even though he is a well control instructor, he has a businessman's mindset. IOTS's mission is to provide a high quality of well control training to oil and gas personnel in a positive and safe atmosphere. Hence, IOTS staff facilitate all the required services to achieve their mission and to make the training at IOTS a smooth and pleasant experience for all candidates. For example, IOTS provides the following services: airport meet-and-greet, a luxurious limousine to transport the candidates from the airport to and from their hotel, taxi service for daily ground transportation for those who do not have a vehicle, dinners when they conduct the simulator sessions and when the candidates stay at the centre to complete their assignments. All the above services are arranged and provided to ensure that (a) the candidates concentrate on the training and not worry about their accommodation or transportation, (b) each candidate leaves the IOTS centre pleased and satisfied.

In order to achieve the above gaols, IOTS spends a lot of effort and money because they believe that word-of-mouth is the best advertising and marketing tool in most businesses. As a matter of fact, many candidates take their training at IOTS just because they trust the

recommendations from their friends and colleagues who have previously taken the training with IOTS.

4.2.2 Course materials

The course materials consist of a textbook (manual), hard copy of the PowerPoint presentation, exercises (handouts), and daily assignments (homework). Each candidate receives a binder of all the course materials the first day of the class. The materials come in either API or SI unit, depending on what the candidate has requested.

For the new candidates, the manual is easy to read and easy to find the information. They report finding the course materials well-organized. In contrast, the majority of the candidates who have taken the training more than once, the manual is just a waste of paper because this course is intensive and extensive, and there is no time to look for the information in the textbook. However, these candidates agreed that the manual is useful for future reference and the assignments are a great reminder of the important subjects that they learned during the IWCF training.

The interviewees all agreed that the exercises and assignments are excellent and sufficient, stating that all they need to know to pass the test is contained in these exercises and assignments.

4.2.3 Facility

They all agreed that both the Calgary centre and St. John's centre are at very accessible locations and have a lot of parking for those who have a vehicle. Both locations are easy the find and can be reached by using different roads where they can avoid traffic. They all like the class size, which is ten candidates in the Calgary centre and eight candidates in the St. John's centre.

This class size allows them to ask questions and have discussions with the other candidates in the class, and talk to the instructor. Typically, the class sizes at other training centres are larger and therefore the instructors must limit the candidates' questions and discussions.

The interviewees complimented IOTS staff on their professional efforts to provide a comfortable atmosphere and were thankful for the Administration Department at IOTS for arranging airport pickup, ground transportation, and accommodation services for them. Accordingly, one of the combined surface and subsea supervisors indicated that, "when I have to renew this certificate, this is where I will be coming. I like the facility, I like people who I'm dealing with here, and I also like the class size as well."

They appreciate that IOTS puts extra money into providing complementary refreshments and appetizers to help the candidates stay awake during the class. It also makes it easier for the candidates who come from outside the province and may have no vehicle. They are also grateful to IOTS for covering the parking pass fees at the St. John's location.

Due to their need to renew their certificate every two years, 38 of the participants stated that they would come back to renew their certificate at IOTS because they believe that it is the best place to take IWCF well control training. The other two participants doubt that they will renew their certificate at IOTS for two reasons: first, teaching the class in two units was very annoying for them and a waste of their time, and second, combining engineers and consultants with rig personnel in one class was inconvenient for them. According to them, engineers and consultants like to talk a lot about their experience and they argue with the instructor about everything just to prove their point of views, which had a negative impact on other candidates in the class because they hesitated to get involved in discussions with them.

4.3 IWCF Program Modules and Level of Competence

This theme varies depending on which module of IWCF training - practical assessment (PA), equipment (EQ), or principles and procedures (P&P) - is more related to the participants' job responsibilities, which has an impact on developing their level of competence. This theme addresses the subquestion: "Which module of the three IWCF program modules can develop the competence level of trainees in mastering their job duties?" In order to answer this subquestion, I start with presenting how the candidates define the adequacy of the IWCF assessments, and then how they justify which module is more related to their job duties.

4.3.1 The adequacy of IWCF assessment

The participants from surface driller level believe that both written tests the equipment (EQ) and principles and procedures (P&P) are very difficult. The allotted time for the EQ or P&P test is not enough since the questions are so "tricky." They argue that they need more time to reread the question several times to first understand the question before picking an answer. Furthermore, 40% of the surface driller level claimed that the allotted time for the P&P test should be more than one and a half hours because they need to review their calculations many times, especially the kill sheet calculations.

Participants from the surface supervisor level however point out the practical assessment (simulator) is different from real life situations. When the assessors conduct the simulator session they must use IWCF criteria to assess the candidates' ability in circulating out the kick and keeping the drillpipe pressure (DPP) or bottom hole pressure (BHP) constant. A kick is a well control problem that occurs when "the pressure found within the drilled rocks is greater than the mud hydrostatics pressure that will force the formation fluids into the wellbore" (kicks, 2014).

As mentioned in Chapter Three, each simulator session consists of a supervisor who controls the choke panel and driller who controls the driller panel. According to the IWCF practical assessment manual, while they circulate the gas out if they face any problem, which they will, they also have to shut the well in first then identify the problem and determine how they will solve it before to circulate the gas out again.

According to 70% of the surface supervisor level participants, in real drilling situations they usually do not shut in the well because they have the experience to identify the problem quickly and act accordingly. For many companies, shutting in the well means stopping the operations and production and would cost the company hundreds of thousands of dollars. They also state that, from their experience, if they know what the problem is they keep on going, because if they start shutting in and opening up the well they can actually end up in a worse situation. However, shutting in the well when there is an issue is the safer procedure that can protect the personnel's lives, environment, as well as the integrity of the well. Moreover, shutting in the well when an issue rises is the proper procedure, especially when the rig has some unexperienced personnel who might not have the knowledge and experience to deal with certain critical situations. Therefore, shutting in the well gives these personnel time to review what went wrong, and review their calculations before making their decision on that revision before they start opening up the well again.

Two participants from the combined surface and subsea drillers reported that the IWCF written tests are very difficult and they set up for failure. They also stated that these exams target people who have the knowledge and experience of well control because they will be able to pass the test. However, on the subject of the adequacy of IWCF assessment, all participants from

combined surface and subsea both driller and supervisor levels reported that the IWCF assessment is adequate. The simulator sessions help them to understand the connection between the practical procedures as well as the theory behind it.

4.3.2 The Relationship between IWCF modules and job responsibilities

The following discussion will present how each group identified the module that related to their job responsibilities and how it could develop their level of competence.

According to the IWCF course syllabus, the training must present the function of the equipment in the course title. All candidates from all levels must identify the equipment components and their functions. However, the majority of the participants have never seen these parts of the equipment in their daily job because they are not authorized to take the equipment apart or attempt repairs to it. In other words, their job duties do not include breaking down the equipment and identifying all the little pieces. All equipment must be certified from the manufacturer. If they have any issue with the equipment, they have to call the rig mechanic or electrician who can check the equipment and attend to the issue. Therefore, 70% of the participants from both surface and combined surface and subsea endorsements believe that IWCF training helps them to be aware of the equipment components and their functions and to be able to identify each part. While the rest of the participants find that teaching the equipment parts is unnecessary information that should be deleted from the course because there are many components, and it is very difficult to remember their names and functions.

For young roughnecks, assistant drillers, and drillers, the equipment part of the training is more related to what they do in real life. Furthermore, three young surface drillers who are going to work overseas with international employers for their first time were concerned about being

responsible to complete the kill sheet calculations because on Canadian rigs the supervisors are responsible for the kill sheet calculations. In contrast, the majority of the surface drillers do not do the kill sheet manually; they use a computer software program that does all the calculations. Experienced surface drillers state that P&P portion of the training is more related to their current job, because they do not deal with the equipment anymore. Some of them struggle with the kill sheet calculations, not because they have issues with math, but because they have not done it for a long time or delegate it to assistant drillers who work under their supervision.

Meanwhile, for six participants from surface supervisor level who have been working overseas, the EQ and P&P go hand-in-hand because they are relevant to all drilling operations and they do not sit in the Driller Cabin the whole day "crunching numbers." They pointed out that the calculations are just one step of the drilling process. They have to keep other drilling operations under control, and if a certain operation accidently changes, it may drastically affect the integrity of the well, the supervisors would have to contact the team leader or the company man and engineers in town. These individuals are the ones who have to make the decision regarding the required procedures that must be undertaken based on the last recorded numbers and activities.

For all engineers from both endorsements, the P&P module is more applicable to their job responsibilities because they are situated in the office and deal more with theories and principles. Due to the fact that engineers and consultants do not deal with the equipment in their day-to-day operations, they enjoy taking IWCF training because it refreshes their memory on the equipment.

For all respondents at the combined surface and subsea driller and supervisor level both modules, the EQ and P&P are related to their job. Therefore, having knowledge of both is helpful to pass the test because they are tightly related. They believe that being knowledgeable about both aspects is very important to be competent at their job and to deal with wells if they are put in a situation that they are not familiar with. All supervisors from this category started their oilfield career as a leasehand, and working their way up to supervisor level. So, as leaders, they were familiar with all the job responsibilities for all personnel who work under their supervision. However, they still believe that they have to update their expertise about the equipment and new technology.

All 40 participants stated that the equipment that the course covers is very general, whereas they deal with many different types of the equipment out in the field. Nevertheless, IWCF training gives them an adequate overview of how the general equipment works.

The practical assessment (PA) basically tests the participants' understanding of their responsibilities, with regards to dealing with the kick. All participants find the PA is adequate for its purpose, which is assessing their drilling skills as drillers or supervisors. However, they find dealing with software simulators is challenging to a certain level, especially when they try to control the DPP or the BHP constant.

From the above interpretation and analysis of the relationship between IWCF training and job responsibilities, the participants' perceptions validate the first and second research assumptions: (1) focused training and certification enable drilling personnel to acquire and develop knowledge and skills, and (2) IWCF training aims at developing a highly skilled workforce to compete in the global oil and gas industry. IWCF as well control training therefore

has the ability to provide the knowledge and skills that drilling personnel need to compete in the oil and gas industry.

4.4 The Importance of IWCF Certification

This theme explores how IWCF candidates identify the importance of holding IWCF certification to their career. In this section, the subquestion "What are the participants' perceptions about IWCF program with respect to its importance and its effect on their need to keep their jobs?" is addressed. This theme sheds light on how the participants define the reasons behind taking this training and whether they agree or disagree with mandating this type of certification. Varied perspectives and opinions were obtained from the analysis of the qualitative data that underscore how important IWCF certification is to the participants' careers. Furthermore, this subquestion seeks to determine the effect of the participants' need to keep their job, and how this motivates them to pass the IWCF training.

As noted in Chapter One and Chapter Two, the international oil and gas industry has experienced many deadly blowout accidents such as the Piper Alpha in 1988 and the Deepwater Horizon (Macondo) in 2010. These major accidents have forced the oil and gas industry to pay more attention to what must be done to develop safe well operations. Even though the international oil and gas industry had not fully recognized the importance of standardized well operations training, it has made small improvements in the efficiency of well operations crews. As a response to Oil and Gas Producers (OGP) Report No. 476 (2012) recommendations, most oil and gas companies enforce well operations certification and make it one of the main job requirements. Therefore, it is known to all oil and gas personnel that they have to be certified to work in wells operations either drilling well control or workover and completion because as the

wells become more complicated they also become more expensive and are associated with great cost. There are only two universally recognized well operations certificates: one from the International Well Control Forum (IWCF) and the other one from the International Association of Drilling Contactors (IADC). Some companies require IWCF and some require IADC based on the company and the country legislation. The majority of international oil and gas companies and drilling contractors demand either IWCF or IADC certificate for all personnel who are involved in the drilling activities. Usually, the drilling contractors are driven by the oil companies with reference to which certificate the personnel must obtain.

In order to interpret the candidates' perspectives of the importance of IWCF certification to their career, I have to clarify to the reader the main differences between an oil company and a drilling contractor. An oil company is the one that has the right to explore or develop a concession. The concession is an agreement between the government or local authority and the oil company that must be obtained to allow the oil company to explore and discover a property. In most cases, the oil company would have partners in the concession. This is a common way of reducing the risk while the government maintain around 51% shares in the concession.

The oil company may choose to manage the project themselves or they may tender it for a "Turn Key" contract for some or all of the services. If the oil company is managing the project, the various services tendered are, but not limited to, the following services: drilling rig, mud logging, directional drilling, casing running, logging, fishing, cementing, and drill stem testing.

The service companies will complete the tender documents and submit them to the oil company. An oil company will then assess the tender for technical and commercial requirements. Once the technical and commercial review has been completed, the contract will be signed after

defining the liabilities. An oil company is ultimately responsible for the well design and has overall authority of the rig location. A drill site supervisor or company man is normally in overall charge of the location and drilling the well. In addition to the company man, the oil company may have the following personnel: night drill supervisor, night company man, geologist, drilling engineer, logistic coordinator, HSE advisor, and fluid advisor. The oil company would also have at their area office the following personnel: president, general manager, operations manager, drilling manager, drilling superintendent, drilling engineers, and safety manager.

The drilling contractor is generally contracted on a Day Rate to provide rig services to an oil company. The drilling contractor would have some policies and procedures that must be aligned with the oil company policies and procedures. The two companies must issue what is called the "Bridging Document" that explains in detail the policies and procedures to be followed. The oil company has the right to take over the rig in the event of a well control situation. The drilling contractor generally has the following personnel: rig manager, day tool pusher, night tool pusher, drillers, assistant drillers, derrickmans, roughnecks, and leasehands. For the purpose of well control, the drilling contractor generally supplies the personnel and equipment for well control and the oil company makes the major decisions regarding general well control practices. All drilling contractors are driven by the oil operators. The oil companies usually enforce their standards regarding what type of drilling well control certificate the drilling contractor's personnel must hold, whether it be IWCF or IADC certification.

The above explanation will help the reader understand the reasons behind varied perceptions about the importance of IWCF certification among the participants. IWCF

certification is the highest standard in the oil and gas industry. It is the most well-known well control certification and the highest level in the North Sea. The purpose of these standards is to enhance technical integrity, improve safety, reduce production cost, and protect the environment (OGP Report No. 440, 2011). From a historical point of view, IWCF established in 1982 to provide well control training and certification in Europe and it used to be called European Well Control Forum (EWCF) (IWCF Historical background and structure, 2014). Then, in 1992, the assessment and certification programs were developed to be internationally recognized and that is when the European Union agreed to change the forum name to International Well Control Forum (IWCF) (IWCF Historical background and structure, 2014). IWCF works closely with the National Regulatory Bodies and the industry organizations such as the International Association of Oil and Gas Producers (OGP) (IWCF Historical background and structure, 2014). Therefore, it is a very good institution to give standardized well control training for oil and gas personnel. Standardizing well control is safety-related in order to keeping some continuity on how to conduct well control operations.

Consequently, the participants have different perspectives of the importance of IWCF certification to their career. Yet, all the participants who took part in this research had to take the training because of job requirements. They also believe that it is the only way to prove their level of competence, and one of the surface supervisor mentioned that, “it is just a ticket which will prove for whatever company that I am competent to do this job.” Moreover, liability is one of the most factors that any oil company and drilling contractor must consider. Personnel are required to have the requisite industry level of competence, and IWCF certificate is a tool to increase that level. Having competent personnel is very important in the case of well blowout incidents. As

Burt & Stibbs's study (1991) noted that the drilling industry must impose mandatory training as an essential requirement to work on either onshore and offshore rigs. Oil companies have to prove to the insurance company that all their personnel who are involved in well drilling operations are competent with regards to knowing their duties and that they are all certified.

The interviewees all agreed that the biggest concerns in the industry are (a) whether the team leaders have the qualifications to lead a team and manage a project, (b) and they have the sufficient leadership skills to be a leader. Therefore, they need this certificate to be competent as a crew member, because not being competent is dangerous both to themselves and everybody else on the rig. IWCF and IADC certificates are worldwide standards for well control training. However, 30% of the candidates believe that IWCF marketing procedures and the support they receive from the European Committee for the oil and gas industry are the reasons that IWCF is popular than IADC. For that reason the participants' companies enforce IWCF over IADC.

At the end of the day it is all about "finance." If the rig blows out or burns down, the oil company will argue with their insurance provider that all their personnel are trained to the level of the industry legislation. For the above purpose, anyone on the emergency call list must have an IWCF certificate. Even ship captains must have an IWCF certificate at combined surface and subsea supervisor level because they are the ones who make the decisions in case of blowouts or fires on the platform rig.

The majority of the companies require IWCF certification because of country legislation and they have no choice. Otherwise, the company would not spend a lot of money on training and its requirements such as flights, accommodation, and transportation, but if something

happens on the rig, there is no back up from the office, so staff have to be competent and have a valid well control certificate to appease the insurance company.

Surface driller level participants indicate that holding IWCF certification will open more doors and provide them various international opportunities. It is useful if anyone gets transferred to another country because they can go wherever the company operates with it. Also, it helps their minds deal with numbers more readily. For those who took IWCF training for their first time, they found the course to be very advanced compared to First Line or Second Line courses. However, they learned new and constructive information related to the equipment and the theory behind the practices.

Whereas six of the surface supervisor participants who took the training more than once reported that IWCF training has increased their knowledge of well control each time they have taken the training. They also view this training as a tool to verify that they have the adequate knowledge and understanding to deal with well control situations.

They also stressed that the drilling industry relies more on experienced personnel than educated personnel. That does not lessen the value of education, but most of the activities in the drilling industry, especially well control operations, need confident personnel who know how to deal quickly and wisely with critical well control situations and can save the rig from a blowout because of their knowledge and experience. Therefore, IWCF training helps seasoned personnel who have no formal education to increase or maintain their competence level and to refresh their memory. All oil operators' and contractors' main priority is to have competent personnel.

All four surface supervisor participants, who work in Canada for Shell, Seadrill, BP, and Husky, are required to have an IWCF certificate to work on projects operated by any of these oil

companies. Even though they work in Canada where First Line and Second Line certificates are the only required well control certificates for rig site work, they still have to hold IWCF certification. As a matter of fact, all four participants completely rejected the IWCF certificate because, from their perspective they are Canadian and have drilled in the very severe conditions found in the freezing climate of Foothills region. Consequently, they believe that they are more competent than drilling personnel from other nationalities. In addition, they believe that the in-house well control training that their company provides is sufficient. They claimed that IWCF pushes their courses and certification, and it is internationally acceptable because it is from Europe but, "Canada is not part of Europe," so Canadian companies must follow their own well control standards. One of these four participants claimed that all well control training programs are the same and IWCF is no different from First Line or Second Line. Another one indicated that he only took IWCF because it is mandatory. "If it is not a mandatory, I would never take it on my own." He also stated that, "IWCF training can't teach me how to do my job; I know how to do my job. It's just a piece of paper that allows me to maintain my job."

In contrast, combined surface and subsea drillers indicated that IWCF training has helped them understand their position responsibilities as drillers and has enriched their qualifications to lead a team. One of these drillers remarked that, "the reason I'm taking this training is that I like to be professionally adapted to what I do." Another one claimed that there are many well site supervisors who should not be out in the field because they do not have the knowledge and experience to lead a crew, and are there just for the dollar.

All combined surface and subsea participants noted that one of the significant benefits of IWCF certification is the opportunity that the training provides to exchange different

experiences, because everyone comes to the classroom with their own personal background. The training allows them to share their work experience and enrich each other's knowledge. As one of the participant stated, "I'm walking away with more than just an IWCF ticket. I'm walking away with other people's personal knowledge and experience." They help each other to understand certain aspects of the training by providing examples of similar situations they have experienced on the rig site, and the proper and safe procedures that they have used to deal with such situations. As a matter of fact, this type of meaningful discussion between the candidates has the ability to eliminate the training barriers among the candidates and motivate them to participate in a discussion using their experience to justify their point of view. By the third day of the training they ask each other, "what do you normally do in a real situation?"

Respondents at the combined surface and subsea supervisor level stated that IWCF is not just a certificate, it is their "Driver's Licence." Without it they cannot move up on the platform and do their job. It is the only accepted licence to work offshore for international companies such as Total, Ocean Rig, and Seadrill. They also indicated that they need IWCF certification for promotion and transfer purposes.

One of the engineers stated that the course has not really changed in the last 27 years since the first time he took it in the 80s. He added that IWCF, "challenges you and makes you think correctly to rationalize what is happening on the rig." It produces better personnel because it is difficult for many people to obtain.

However, all the engineers who participated in this research indicated that obtaining the IWCF certificate is a requirement. Besides IWCF certification, they must also pass other engineering exams and various internal advanced drilling and marine courses. Whereas most

consultants have both IWCF and IADC certificates because they believe that having both certificates makes the oil companies and drilling contractors treat them as "Gold."

From the above analysis, for the majority of the participants their career, life, and their family present and future all depend on having an IWCF certificate, because they can maintain their job and will be able to provide a high standard of living for their family and pay their bills. As well, one of the seasoned combined surface and subsea supervisors mentioned that there is a lot of pressure on him because he has four children and his wife does not work, and he has thousands of dollars a month to pay. He added "it all relies on this ticket, whether you are eating this month or you are paying your power this month. I'm done without this ticket."

In terms of functionality, what IWCF training does is give them international standards of dealing with well control issues. Hence, with the integration of foreign workers, they all agreed that the international oil and gas industry must standardize the regulations and principles of drilling operations instead of each country having its own regulations. As Blaauw's study (2012) noted that diverse regulations and standards on regards well integrity would lead to inconsistencies with regards to safety within the industry. For example, Shell has a global standard regardless of which country Shell's operations are taking place. When Shell added IWCF certification as a job requirement, most other oil companies followed because if Shell has chosen IWCF certification in particular, that means it is the highest level of well control standard in the industry. So, if a situation arises, then that driller, tool pusher, or even that operational installation manager (OIM) is going to follow a standard protocol to at least secure the well. The oil company and drilling contractor can trust the fact that because all respective personnel hold an IWCF certificate, they are going to respond to the situation in predictable and understandable

manner. They will ensure the integrity of the well, the equipment, and the safety of the individuals.

From the above varied perspectives about the importance of IWCF certification to the participants' career, all participants need this certificate to keep their job, because it is a job requirement. Some companies inform their personnel that they cannot return to work if they do not successfully pass the training and obtain the certificate, resulting in massive pressure from their company. That has a negative impact on them during the training. Moreover, for one of the offshore companies, if their personnel achieve less than 80% on any of the three IWCF modules, they cannot return to work.

On the contrary, having an IWCF certificate will allow them to work internationally, guaranteeing that they have a constant paycheck. They are all terrified of losing their job because they have families to feed and many other monthly expenses, and all that depends on this certificate.

Furthermore, from a personal perspective, having this certificate will allow them to work on a time rotation. Usually international companies arrange their personnel work shifts in either 28 days on to 28 days off or 35 days on to 35 days off. Working on time rotation allows the candidates to have a more stable social life and they can make plans with their families. Some oilfield personnel suffer broken marriages and relationships due to the demands of working away. The majority of them told me that their relationships have improved since they manage to spend more quality time with their family. When they used to work in Canada, they would work for 3-4 weeks in a row then have 4-5 days off to spend with their family. In addition, if they are from the East Coast and work in Alberta, then that means two days are wasted on travelling back

and forth. During the remaining two or three days, they try to rest and catch up with their family but still “the wife is always upset” according to one of the combined surface and subsea drillers.

Another significant reason to obtain and maintain IWCF certification is their own self-ambition. Most of them believe that working for international employers will help them to go further with their career and provide many good opportunities.

Even though there is pressure from their company to pass the training, they are self-motivated to pass and achieve high marks for their own personal pride. Also, their company motivates them by offering a promotion upon certification. I have witnessed many cases where the company sends the same employee to get the supervisor level certificate within a few months of obtaining the driller level certificate. The reason behind this is many international companies have faced a shortage of skilled workers due largely to retirement and rising technical complexity, as presented in Hopkins’s study (2008). Therefore, these companies are willing to spend a few thousand dollars on their young employees to fill a higher position. So if they have seen potential in any of their drillers who are talented and willing to learn and improve their skills, they send them again for training to get the more advanced IWCF certificate at supervisor level.

4.5 The Definition of Safety Leadership Skills

This theme presents the definition of safety leadership skills from the participants’ perspective. This section addresses the subquestion: “What is the definition of safety leadership skills from the drilling personnel perspective?” Their definitions are based on their own work experience and their demonstration of these skills when they lead their crews out in the field. First of all, each one of the candidates who participated in this research is a leader. The drillers

lead a crew of leasehands, derrickmans, roughnecks, and assistant drillers. The supervisors lead a crew of drillers, tool pushers, technicians, and rig managers. Therefore, they all need to demonstrate safety leadership skills, because both are at leadership positions. Since both drillers and supervisors are involved in high-risk operations, their leadership style must emphasize safety because safety culture starts with leadership according to Oil & Gas Producers Report No. 452 (2013).

The main mission for all oil companies and drilling contractors regarding safety is that "everyone who works on the drilling rig must go home safe with all their fingers and toes everyday." From this perspective, all participants affirm that they have to explain to their crews what the consequences are of unsafe behaviour and all the risks associated with them. Most drilling rigs use what is called an "Observation Card," or a "Stop Card." Both of them are used to record or stop unsafe behaviour and attitudes that happen on day-to-day basis. At the start of each shift, the crew leaders review the main safety procedures and give the crews some safety tips. This kind of small safety talk is crucial to ensuring that all crew members are aware of their responsibilities. Thus, before they start any critical tasks they discuss each individual role in that task and what must be done if something happens before they carry out the task.

Likewise, if the observation or stop cards identify a high risk or unsafe attitude, the crew leader must discuss these attitudes in a safety meeting and inform the rig crews that everyone is responsible to look for, stop, and report unsafe behaviour. In other words, the observation or stop card aims to empower all crew members to identify and stop unsafe behavior and correct it before they proceed with the job. Even though the drilling activities are associated with high risks, the rig could be a safer work environment when all crew members have the skills and

knowledge to do their job safely. That is also demonstrated in Henson's study (2013), where he claimed that offshore drilling rigs could be safer if every crew member has the safety awareness and skills to manage risks. He also found better leadership is an appropriate method for safe performance.

All participants, without exception, agreed that "leading by example" is the most effective leadership style to sustain safety on the drilling rig. Leading by example is a very powerful tool, when the leaders are involved in the drilling procedures and tasks, as mentioned in Chapter Two of this research. They do not lead from sitting in the office; they have to be out in the field and know how to explain the risks in a simple way so the crews can understand how to avoid or reduce risks. Usually, in any drilling crew, members follow what their leaders do and how they perform in certain situations. If their leaders cut corners and take short cuts, their crews will do the same, because they think it is normal and that it produces the same results. They pick up everything that their leaders do, whether it is good or bad. Therefore, the leaders must fully understand and follow the company's safety policies and procedures. Also, they have to be aware of occupational, health, and safety legislation for the country where the drilling practices are taking a place.

Furthermore, they added that leading by example means that leaders have the ability to explain the reasons behind any instructions they give to their crews. Telling them "do not do that" will not make them safe workers, but giving them reasons why is what will produce safe workers. In other words, relevant explanations are the most efficient way of making use of prior knowledge and experience.

In addition, leaders must realize that blaming people is not going to teach them the proper safety procedures, but it will make them afraid of talking to their leaders if they do not understand certain tasks. They will keep proceeding with their tasks, assuming that they know how to do them and they will make more mistakes because they do not have the knowledge and experience to deal with some critical situations.

Moreover, all participants believe that continual communication between leaders and their crews is the key factor for leading by example. If the leaders see unsafe behaviour from any member of their crews, they have to take that person aside and explain why this behaviour is not safe, what the consequences of this unsafe manner can be, and how it might affect people and equipment on the drilling floor.

On one hand, the analyzed qualitative data indicate that safety leadership skills mean that leaders are reliable and proficient at their job, know each crew member's job responsibilities, and are able to identify everybody's ability. Having these qualifications allow leaders to be comfortable managing their crews and know that they are competent to deal with critical well control situations when they occur.

On the other hand, the analyzed data showed that having over eight years of international experience working for large organizations such as Shell, BP, Chevron, Seaderill, Ocean Rig is an asset for the majority of the participants. They pointed out that there are two main advantages to working for international employers on projects that help them to improve their safety leadership skills. First, they have become more safety-conscious and oriented and they believe in the necessity of improving and maintaining a safety culture. Second, working with locals helps them develop many personal aspects that have great impacts on improving their safety leadership

skills. They become more concerned, rational, and respectful for their crew regardless of their ethnicity, and more patient, especially when there are language barriers.

One of the significant findings shaping the definition of safety leadership skills, is the leadership styles the participants use to manage their crew. When I asked them about whether they prefer transformational or transactional styles of leadership (Chapter Two defines these two styles of leadership), their responses to this question could be categorized into three groups:

– *Group One*: includes the participants who work in Canada and never worked overseas and the ones who have one year of international experience. This group believes that a transactional style of leadership is the more dominant and powerful style. According to them, it is the only style that they know and use because of the nature of the drilling activities in Canada, whether in Alberta or Newfoundland. These activities require obedient crews who carefully follow instructions that they receive from their supervisors. They state that the drilling industry in Canada is based on a "Dictatorship," where the power is granted to certain individuals who hold higher positions on the rig hierarchy, such as field superintendent, drilling supervisor, or rig manager. They believe that this style makes them work better and stay focused. For example, one of the surface drillers who just started working in Australia, where safety is the first priority, expressed his dissatisfaction with using the transformational style on the rig where he works. He claimed that when he used to work in Alberta, he never made any mistakes because he worked better when his supervisor "yells and screams at him" to complete the job safely and quickly. This situation is exactly as Houser' study (2010) described working on drilling rigs in Alberta. This candidate mentions that he received a warning during his

first rotation in Australia because he climbed the rig tower without wearing the safety harness, whereas if he did the same unsafe behaviour on a Canadian rig his supervisor would be screaming at him instead.

- *Group Two*: includes the participants who have two to seven years of international experience. This group is obligated to use a combination of both styles of leadership, because of the signed agreement between the oil company and the drilling contractor. Another reason for this enforcement is the country legislation that obliges the oil company to provide jobs for locals. The participants from this group indicate that using a transactional style all the time does not work well when you have 40% - 50% of locals working on that rig because that might cause some issues with the government in that country.
- *Group Three*: includes the participants who have more than eight years of international experience. This group stated that good leaders are the ones who can evaluate the situation first, then adapt their leadership style accordingly to generate crews' engagement, switching between and mixing transformational and transactional styles. They must also take into consideration the agreed policies and procedures between the oil company and the drilling contractor and the country legislation.

Nevertheless, the most unexpected finding was that the older leaders, who have been working internationally for more than eight years, are typically transformational/situational leaders. They have remarkable experience that has taught them how to deal with different personalities, cultures, and drilling backgrounds, and they usually motivate their followers to do

better at their positions. Because they work in many different local and international drilling industries, they are open-minded and want to leave a legacy behind in each place they work. Therefore, they delegate some of the more crucial responsibilities to their younger followers to allow them to learn different perspectives of the drilling operations. They discuss procedures with their followers to allow them express their opinions and concerns regarding the best procedures that should be undertaken in that particular situation.

As a result, all participants define safety leadership skills as the ability to identify hazards with every new situation. Therefore, leaders must have certain qualifications to be a safety leader. For example, leaders must

- be diligent workers showing care and conscientiousness in their duties,
- have the knowledge and confidence to deal with critical drilling situations,
- develop their ability to find and recognise hazards and to promote self-awareness among their crews who work under their supervision,
- be brave enough to ensure that the crews follow safety procedures when they face some challenging conditions such as weather, geological issues, fluctuating pressures, and strict country legislation.

To sum up, from the analyzed qualitative data, I collected the skills that the participants describe as essential for each drilling leader, whether a driller or a supervisor, to have to be a safety leader. Their description reflects their leadership style and the main characteristics that both transformational and transactional styles have, as noted in Chapter Two. Moreover, their descriptions overlapped in many aspects about the safety leadership skills that OGP Report No.

452 (2013) defines as the primary skills for a safety leader. A brief description of these skills is presented as follows:

- **Credibility**: good leaders are the ones who "walk the talk." They set a good example and are role models for their crews with regards to maintaining the integrity of the safety culture within the company. They also delegate some of their responsibilities to their crews, because they trust and believe in their abilities and skills. They discuss the decisions with their crews and they accept any input from them. As a result of such discussions, they are willing to change their decision if they receive better ideas from their crew. Above all, they admit their mistakes and demonstrate their concerns for providing a safe work environment.
- **Communication**: good leaders are good communicators. Their unique way of communicating encourages their crews to trust them and their experience and knowledge. They always motivate their crews to ask questions to learn the proper way of proceeding with some tasks.
- **Being proactive**: good leaders are the ones who are able to identify risks before accidents occur to ensure nobody is injured. In particular, if these leaders have started their rig career from the lowest position, such as a roughneck, to their current position, that means they understand the potential risks of working on a drilling rig. Furthermore, proactive leaders ensure that their crews are well-trained and certified to the industry standards. They also conduct safety meetings or provide safety tips before starting any complex operations, to guarantee that everyone knows their role and they encourage their crews to report any safety issues and track near misses.

- **Accountability:** good leaders are those who act as role models for their crews and take responsibility for implementing safety measures when they conduct drilling operations. Most importantly, they take responsibility for their actions and mistakes. Accountable leaders maintain the company safety culture and mission, demonstrate commitment to their company legislation, and spend effort and time correcting unsafe behaviour.
- **Motivation**: good leaders motivate their crews to be more efficient at their job. They provide opportunities for their crews to participate in discussions, the decision making process, and problem solving. They also encourage their crew members to suggest alternative actions that might meet with the company vision and maintain the safety culture. Motivation also includes giving the crews continuous feedback about their performance to improve the functionality for each crew member. They ask crew members for feedback about their performance and what should be done to better improve safety. In addition, giving or receiving feedback must be followed by recognition to encourage safe behaviour and reduce unsafe behaviour in order to develop and maintain a safety culture that reflects the company vision.

This list of defined safety leadership skills demonstrates the validity of the third and fourth research assumptions, in terms of the necessity of having technical and non-technical skills for leaders in a hazard industry. The participants identified the safety leadership skills that leaders must have to lead a crew, and a good leader is the one who can demonstrate these skills in the workplace and be a role model for their followers. A good leader is one who knows their crews and adjusts their leadership style according to each situation.

4.6 The Relationship between Technical Training and Safety Leadership Skills

This theme explores whether or not technical or applied training such as IWCF Rotary Drilling Well Control Training Program can improve safety leadership skills. It answers the subquestion: "What is the relationship between applied training programs and developing safety leadership skills?" The findings of this theme reflect how IWCF candidates value IWCF training and its ability to develop nontechnical skills.

Surface driller participants believe that IWCF training as technical training has the ability to improve safety leadership skills that relate to well control operations. They learned from this course how to react safely to unexpected well control situations to prevent injuries. The decisions that they make in the field reflect the education they receive from this course and their understanding of well control operations.

Seasoned surface drillers reported that IWCF training can help leaders to better know their crews and the strengths and weaknesses of each crew member. They can pass along the knowledge that they obtained from this training to their crews such as most roughnecks and assistant drillers and build up their level of competence until they are ready to take this training. Their supervisors noticed that these more junior crew members have the potential and ability to pick up the advice and directions that their supervisors had given them and they were able to demonstrate safe behaviour that made their supervisors trust their performance. Furthermore, their performance proves that these personnel have very important attributes, such as great determination and future goals to improve their skills and move forward in their career.

In contrast, 10% of the respondents at surface supervisor level expressed a narrow vision with reference to IWCF training and its ability to develop safety leadership skills. They stated

that IWCF training has nothing to do with safety or leadership; it is purely technical well control training. In addition, they argued that there were some other specific training programs to improve safety and leadership skills in particular. They also claimed that IWCF instructors never include the subject of occupational safety and leadership style in the IWCF course.

Definitely, these two subjects are not the core of the course, however each part of IWCF training aims at developing safety awareness among trainees by presenting the proper well control procedures to avoid or reduce risks. The presentation of these procedures helps to save the integrity of the well and the personnel's lives. Since the IWCF course is provided to personnel who are in leadership positions, such as drillers or supervisors, this course teaches them how to react safely in any well control scenario to protect their crews and the integrity of the well.

Supervisors from both endorsements indicated that working on drilling rigs means dealing with many unexperienced crew members, or "green people". This term is used in the oil and gas industry to describe personnel who do not have the adequate knowledge and experience to deal with critical operations. This term also includes the new engineers who have just graduated from school. Some of those new personnel hold higher positions than they are supposed to because of lucky or connections. Having some "green people" working on the rig site means incidents will continue to happen, even if they are minor. The only way to avoid or reduce these incidents is by developing risk awareness and technical skills among new personnel. Therefore, everyone on the rig floor must be a safety leader. That is what IWCF training does, it develops safety awareness by presenting all types of risks that might happen when a well is drilled. If the drilling crews especially the leaders who are in decision-making roles are well-

trained in well control, they can then argue with their crews and even with engineers-in-town on the best decision to be made to protect crews and the integrity of the well.

Furthermore, the respondents at the supervisor level from both endorsements claimed that hiring safety officers on the rig site is evidence of a lack of understanding of the real meaning of safety leadership. If the oil company hires safety officers on the rig floor to monitor risks and hazards, all that they can do is to advise crews on how to minimize these risks and hazards. That is to say, having safety officers with no drilling background is not an effective way to implement safety.

All participants believe that IWCF training or any well control training aims at educating drilling crews about well control and the risk associated with the drilling operations. However, only 70% of the participants believe that understanding risks in well control is a piece of education that they can apply to all other well operations and activities.

One of the significant findings highlights the importance of developing safety leadership skills when crews deal with heavy equipment. About 40% of the participants grew up on a farm; therefore, they have experience around heavy equipment and machinery and one aware of the potential dangers. They all indicated that their fathers taught them how to walk around the equipment when they were very young kids. Their fathers were their role models, so they followed them and absorbed the correct ways to deal with machinery. Hence, the farming experience helped them to lay the foundations of safety leadership skills, and they have refined these skills throughout the years. When they started working on drilling rigs, it was easy for them to recall the lessons that they learned from their early farming experiences. So, they built their

safety leadership skills from life experience and work experience, which have gone hand-in-hand to make them better leaders.

Similarly, 30% of the participants were fishermen in the province of Newfoundland where the conditions are very harsh and patience is required. Fishery helped them to build a strong sense of danger and to watch out for themselves and everyone on the boat. A Newfoundlander participant shared with me an amazing story about how he transferred his safety leadership skills from his fishing career. According to him, like most fishermen, he sailed in small open boats and would go fishing with his father and three brothers. As the big brother he was also responsible for the safety of his brothers, as well as his fishing duties. When they brought back their catch, they prepared the fish themselves to be shipped to merchant companies. All these efforts paid for basic gear and supplies but little left for their families. When the fishery industry developed in 1970s they started to deal with big boats and heavy equipment and they become even more cautious workers.

One of the surface supervisor participants gave another relevant example of the importance of being aware of self-responsibility toward safety. He stated that his experience with the Canadian Navy had a great impact on shaping his safety leadership skills. He learned how to act quickly and correctly under high pressure in any situation without losing his patience or letting anger controls his actions. He stated that there were around 300 personnel on his ship in 1996, and that there was no need for safety officers because each individual fully understood that safety is a value shaping all their actions and decisions. Accordingly, a culture of safety was embedded throughout the Canadian Navy.

In contrast, 50% of the participants claimed that some companies shape their safety culture through filling out all the required paperwork, checking the equipment, completing risk analysis, conducting safety meeting only to justify the insurance requirements. They divorce themselves from personal responsibilities for safety. They have not been able to internalize the safety culture as a responsibility that must trickle down from the company president or CEO to the leasehands.

4.7 Years of Experience and Building Safety Leadership Skills

This theme focuses on identifying whether or not there is a relationship between the numbers of years of work experience and building safety leadership skills. It aims to answer to subquestion: "What is the relationship between work experience and developing safety leadership skills?" To define the proposed relationship, I will first discuss the reasons behind working for international employers, then investigate whether local or international experience plays a role.

4.7.1 Local experience vs. international experience

To allow the reader to understand the differences between having a combination of both local and international experience or having only local experience, I will present the countries where the participants have worked in table 4-1. Then I will present the years of local and international experience that each participant had.

Table 4-1 Countries Where the Participants Work

Country Where the Participants Work	Number of Participants
Middle East	9
Australia	8
North Sea	6
Brazil	5
Canada	4
Nigeria	2
Kazakhstan	2
Vietnam	2
Algeria	1
Angola	1

From the above table, nine participants have worked in the Middle East in Iraq, Saudi Arabia, Kurdistan, and the United Arab Emirates. Five of them have worked for oil companies and two for drilling contractors and the other two were consultants. Eight participants have worked in Australia, with only two of them working for oil companies and the rest for drilling contractors. In addition, six participants have worked in the North Sea, with four of them for oil companies, one for a drilling contractor, and one as a consultant. Only four participants have worked for drilling contractors in Canada, whereas four participants have worked for oil companies, with two in Vietnam and two in Nigeria. Two other participants have worked for

drilling contractors in Kazakhstan. Finally, one consultant has worked for an oil company in Algeria and another consultant has worked for a drilling contractor in Angola. The tables 4-2 and 4-3 will describe the number of local and international years of each candidate from both endorsements and levels, as well as the country of origin.

Table 4-2 Years of Local and International Experience for Surface Participants

Participant	Surface Driller			Surface Supervisor		
	Local	International	Country of Origin	Local	International	Country of Origin
1	7	1	Canada	12	5	Canada
2	8	7	Canada	25	0	Canada
3	12	1	Canada	19	0	Canada
4	4	28	Canada	9	8	Canada
5	8	9	Canada	3	16	Canada
6	8	1	Canada	21	0	Canada
7	6	8	Canada	13	0	Canada
8	16	5	Canada	8	24	Canada
9	15	1	Canada	4	21	Canada
10	4	9	Canada	7	27	Scotland

Table 4-3 Years of Local and International Experience for Combined Surface & Subsea Participants

Participant	Combined Surface & Subsea Driller			Combined Surface & Subsea Supervisor		
	Local	International	Country of Origin	Local	International	Country of Origin
1	7	3	Canada	9	12	Canada
2	16	5	Canada	7	8	Canada
3	10	7	Canada	9	7	Canada
4	13	9	Canada	7	23	Scotland
5	12	5	Canada	30	7	Canada
6	13	3	Canada	23	10	Canada
7	5	7	Canada	20	7	Canada
8	3	17	Scotland	5	28	Canada
9	14	3	UK	24	5	Canada
10	15	7	Scotland	4	27	Scotland

The above tables will help the reader understand if experience type, whether local or international, or the number of years of experience has an impact on developing safety leadership skills, as reported by the participants.

All the 36 participants who work internationally indicated that the reason they have worked overseas and left their families is money. Working internationally means they are

continuously paid, whereas in Canada their workloads vary from month-to-month. If the Canadian oil and gas industry is busy and there are a lot of projects, they may work for seven or eight weeks in a row and might be lucky to have one week off or just four to five days off to spend with their families. In contrast, if the industry is slow, they may be without work for months or even be laid off. Since many of them have financial commitments such as mortgages, loans, and tuition fees for their children, being unemployed for few months can be very stressful and burdensome for them and their families. As a result, they decided to work internationally where they have a constant monthly income all year round.

The second main reason for they may prefer working internationally to domestically is the work schedule. Most international companies arrange their personnel work schedule according to a time rotation especially for foreign employees who are not residents of that country where the operations take place. Some companies go with 28 days on to 28 days off, others go with 35 days on to 35 days off. Working on a time rotation basis allows personnel to spend more quality time with their families, make personal plans, and attend some essential training sessions that required by their company.

The third reason that pushes them to work internationally is the work attitude in Canada. They stressed that the work attitude in Canada is “Go! Go! Go! Get it done fast!” versus the international attitude “Slow. Slow. Slow. Get it done once but safe.” So, when Canadian personnel work internationally they know how to complete their tasks efficiently because their Canadian work experience provided them with the necessary skills to work internationally, but they must also adjust their speed and slow themselves down to the international company’s speed level.

Nevertheless, eight participants who have worked in Australia complained about the level of liability the crews have, claiming that crews have less liability, whereas in Canada they are in charge of everything. For example, in Canada if a crew faces a mechanical failure or if some equipment need to be replaced, the crews have to fix it and carry out the operations efficiently. If the same situation happens on Australian rigs, they have to stop the operations, and a certified technician will be responsible for fixing the equipment, and replacing the parts, and ensuring that the equipment is safe to use before the crews continue the operations.

My interpretation for this difference between Canada and Australia regarding liability is that the oil and gas industry in Australia is new and has only begun to boom in the last three decades. Therefore, the government legislation is stricter with reference to safety, health, and environment. All foreign investors in Australia require an IWCF certificate for all their crews who are involved in the drilling operation.

The fourth reason cited for working internationally is the safety regulations. All participants agreed that the international safety regulations and legislation are stricter than the ones in Canada, as international companies follow Norwegian standards, which are quite high. Therefore, 28 participants stressed that the safety regulations are one of the reasons that has attracted them to work overseas. However, there were two different opinions with reference to safety regulations:

– The first opinion was expressed by the participants who thought the regulations were complicated and that they slow the operations. For example, one of the participants at the combined surface and subsea driller level who works in the North Sea mentioned that if one of the crew members scratches a finger, all the rig operations must be stopped to

check the injured person and to provide basic first aid. The safety officer must arrange a rescue helicopter if the injured member needs to go to the hospital. Before they go back to start the operations, a small safety meeting must be conducted to review the incident and to explain what caused it. This meeting aims at affirming that everyone knows their roles and understands the consequences of the incident. The participants from this group believe that these procedures are beyond necessary and they slow the operations and productions. Furthermore, if a similar situation happened on a Canadian rig, the injured person would be pulled a side and would receive first aid without stopping the operations for such a minor incident. According to one of the participants: "We Canadians are more relaxed and practical whereas the British are more regimental. They have to follow A, B, C exactly as it is described or it is not done right."

- The second opinion was expressed by the participants that support strict safety regulations to ensure that all crews are following these regulations, because when they work for an international client they have to respect the agreed safety policies between an oil company and a drilling contractor. In addition, according to government regulations, foreign investors have to hire around 40% - 50% locals. The local might not have the same level of experience as Canadians. So they have to slow the operation speed to ensure that everyone fully understands the given instructions. In some cases, working with locals means dealing with a language barrier, as is the case in Vietnam. This group argues that safety regulations in Canada are well-written but they are not actually followed on the rigs. The oil company and drilling contractor know the safety policies and procedures and know how to complete the related paperwork, but they do not always

> follow them. Working on Canadian rigs is based on the idea that "Time is Money." The crews must carry out the drilling operations and complete the tasks according to the scheduled time, and the faster crews are the winners. Conversely, safety is a priority for international oil companies and drilling contractors because they understand that their contract will be terminated by the country's government if they break the legislation. So, their operation's approach is "take it slow and get it done once but safely."

The fifth reason as to why the participants prefer to work internationally is because they deal with high profile well explorations with a lot of challenges and excitement. They learn more operations and techniques related to drilling, such as workover and completion, cementing, and tubing. They drill very difficult wells associated with high temperature, Hydrogen Sulfide (H_2S) gas, varied depth and both vertical and horizontal wells, whereas drilling in Canada is repetitive. Those who had experience working in the North Sea pointed out that working in the North Sea is more organized than anywhere else, because most of the projects are managed by powerful oil companies such as BP, Shell, and Total. Hence, these international employers spend thousands of dollars on training their personnel, because they believe that well-trained personnel are better able to deal with risks when they arise and increase the company production.

The last reason to work overseas is the weather. The participants claimed that moving the rig during a Canadian winter when the temperature is -40º Celsius is an unpleasant experience. Furthermore, because of the weather, most Canadian oil companies try to complete their projects in other seasons. Therefore, they often cut some jobs because there are not enough projects all year long.

In contrast, one of the surface supervisors who had no international experience mentioned that he had a great career with one Canadian company for 21 years. He never had the desire to work overseas because he did not want to deal with the language barrier. Similarly, he even reported facing some difficulties understanding some individuals from New Brunswick and Quebec who came to Alberta to work on his company drilling rigs. He claimed that it is very challenging working with "French People." According to him English is not the first language for workers from these two provinces, therefore there were some communication barriers. He even claimed to have difficulties working with people from Newfoundland, because according to him "they do not speak proper English."

4.7.2 Learning about the company safety policy

Most companies provide an orientation program for new employees to learn about the company safety policies. Some of them provide one month for practical training to update their information and to learn how to use the equipment that located on the drill floor. Generally, all companies provide their own occupational safety training. Due to the fact that each company has different equipment and they follow certain procedures and principles, they ensure that new employees are aware of these differences. Crew members must also understand the government safety policies and environmental considerations. Therefore, certain operations need a higher representative than a rig manager or a field superintendent to approve them, such as a company man or a drilling engineer.

Some participants pointed out that most Canadian oil companies push productivity over safety. There is a difference between Canada, Australia, and European countries with regards to applying safety regulations. That may be explained by the long Canadian oil and gas history

compared to the European and Australian one. For instance, the oil and gas industry only began to boom in Australia in recent years so the government regulations are very strict, whereas in Canada the industry is more mature. It runs by the old rig mentality that focuses on completing the job. Nevertheless, because safety is enforced internationally and personnel strictly obey the safety legislation, Canadians have adapted their work practices because they want to keep working internationally.

Another significant reason that illustrates the importance of following the company safety regulations is the value of life among crews who work in poor countries such as Angola or Iraq. When well-established companies such as Shell, Chevron, and BP operate in poor countries, all their personnel and even the drilling contractors' personnel must follow the agreed safety regulations and policies. For Canadians, life is an important ingredient and has a value. Even though they do not exactly follow these regulations and policies, it is safe to work with them because they value life. Whereas for locals especially in poor countries, life does not have the same value. It is more important for them to be working every day and earning that paycheck and if something would happen they may feel that it is because it is "God's will." Therefore, the most experienced worker must watch out for the less experienced one. They have to pass on the very important the message that "everybody is a safety leader," no matter what their position and that everybody needs to take care of themselves and others.

In conclusion, most international oil and gas companies follow the Norwegian Standards with reference to safety. These standards have been established to regulate responsibilities for safety to protect human life, health, the natural environment, and financial investments (OGP, 2011). They also employ a performance-based regulatory approach, which contains a few

mandatory technical requirements. These standards include requirements to manage operations, build facilities to meet the drilling objectives, and performance requirements for identifying and reducing risk and management systems to ensure performance achievement (OGP, 2011).

4.8 Training Obstacles

This theme discussed in this section is related to the main obstacles the participants faced when they attended the training at IOTS. It answers the subquestion: "What are the main obstacles that trainees experience while they are taking the training?" These obstacles include instruction methods, the use of training materials, participants' level of education, and examinations.

4.8.1 Instruction methods and the use of training materials

Teaching the class by using both the API and SI units caused some confusion for the new candidates who were taking the training for the first time. For those who had taken the training more than once teaching the class in both API and SI units is unnecessary repetition. They have to go over each exercise and assignment twice once in API and again in SI, which takes away time that could be used for other more challenging exercises. For others, it is useful because it refreshes their memory about the other unit, because the formulas and concepts are the same.

New participants and visual learners want to see more pictures and videos because that helps them understand the concept better and connect it to the theory. In particular, this is helpful when the instruction presents the equipment parts that they have never seen while performing their daily tasks.

The participants also reported that the length of and the time between breaks must be increased so they can maintain their attention in the class, especially for those who smoke. The

majority of the participants schedule their training to be taken during the first week of their time off. Therefore, they leave work and directly proceed to the training. So, the first day of the class is always hard for these who have had an international flight and are experiencing flight fatigue or jet lag.

Usually, the first day of the class is overwhelming for the majority of the candidates especially those who are new to IWCF training. Then once they get to know each other, they start to help each other, both during in-class exercises and outside of class while completing assigned tasks. Both types of engagements allow the candidates more opportunities to have a better understanding of the knowledge included in this course and to overcome the training obstacles.

Participants who attend the training in the St. John's centre mentioned that they would prefer the training to be extended to six to seven days instead of five days. As most of them work internationally, they have several weeks off at home. So if the course is little longer, they will not feel as though they are "under the gun" to move on from one exercise to another very quickly to avoid running out of time. Also, around 10% of the participants who were new to this training argued that the class duration was not enough to absorb all of the information. They believed that the class consisted of very advanced information that required more than five days to cover adequately.

All participants at the combined surface and subsea level wanted to see more information about deep water operations. They thought the course focused more on surface operations that they could apply to jackup operations for those that work on jackup rigs. Around 60% of the participants from this category work on deepwater rigs and they suggested IWCF training should

cover deepwater operations in more detail. The difference between these two types of rigs is that deepwater drilling operations happen with depth range between 10,000 – 40,000 feet, and where they use drillship rigs to drill wells in deep water. Jackup rigs however, stand on the ocean floor on connected legs and are used in water depth of 400 feet or less. The drilling operations on jackup rigs are similar in some perspectives to onshore operations.

4.8.2 Level of education

This sub theme focuses on how the level of education of the participants affects their performance during the training and its role in passing the examinations. Table 4-4 shows the participants' level of education.

Table 4-4 Level of Education of the Participants

Participant Level	**Level of Education**					
	Grade 9	**Grade10**	**Grade 12 (High School)**	**1 Year College**	**Engineering Degree**	**Total**
Surface Driller	-	1	8	1	-	10
Surface Supervisor	1	2	4	1	2	10
Combined Surface & Subsea Driller	1	-	8	1	-	10
Combined Surface & Subsea Supervisor	1	-	5	1	3	10
Total	3	3	25	4	5	**40**

From the table 4-4, three participants have grade nine education, three have grade ten, and 25 participants have completed high school. Also, there are four participants that have post-secondary education, such as an apprenticeship or diploma. One surface driller has a one year Occupational Health, Safety, and Environment (HSE) Diploma from SAIT, one surface supervisor has the Canadian Navel Electronic Sensor Operator Apprenticeship, one combined surface and subsea driller has a Power Engineering Diploma, and one combined surface and subsea supervisor has Technical Marine Diploma. Additionally, five participants have Drilling Engineering Degree: two surface supervisors, and three combined surface and subsea supervisors.

Math is reportedly the main barrier for 40% of participants at the surface driller level, especially for those who are new to IWCF training. During their work experience on Canadian rigs, most of the calculations are handled by their supervisors. Moreover, if their supervisors start to train them to do the calculations, they use a computer software program that does all of the calculations for them, so they had not started to know the details and how they could do it manually. When taking this course, they had to learn how to figure out which equation to use, and since there is no formula for everything, they have to know how to obtain the correct results by using another guiding formula. Because they are not familiar with using the formula sheet or do the calculations, it takes them time to complete these exercises. In addition, they get frustrated when they see the other candidates breeze through this section and do the exercises without any issues. Nevertheless, they mention that if it were not for the instructor and the assistance of some other candidates, they might not have been able to do it on their own. They also pointed out that

the experienced candidates recommended that they practice more doing the calculations and kill sheets manually until the math comes naturally to them.

There are a few differences between younger and older participants with reference to dealing with math and calculations in this course. Younger participants, because they had just come fresh out of school, still had some math skills and they are more adaptable and willing to change. They are also more familiar with video games and smart phones, and that helps them to do better on the practical assessment (simulator). The simulator assessment, much like a video game, requires careful attention and quick decisions based on an understanding of the required action when the drillpipe pressure (DPP) or the bottom hole pressure (BHP) drops or increases. However, they are not so familiar with the equipment beyond its daily use.

30% of the older participants at the surface supervisor and combined surface and subsea driller levels struggle with math because they have been away from it for a long time, and their current position does not require they do the kill sheet calculations, or because they use a computer software program that does all calculations for them. Furthermore, two consultants stated that their job responsibilities are more involved with giving recommendations on how to better the drilling operations. They know the equipment very well as well as most of the principles and procedures. Even though one of them has only grade nine education and the other one just has a high school diploma, they became drilling experts because they have spent all their lives working on the drilling rig. At the same time, some of these older personnel are “like an encyclopedia” and they can do the math in their head because they know all formulas.

One of the seasoned combined surface and subsea supervisor participants left school earlier at very young age because he thought school could not help him in life. He started

working on the drilling rigs and learned more through working. So, since he spent most of his career in the field he tried to figure out his own way to help himself memorize and remember the formulas. For this reason he did not have any issues with IWCF training.

4.8.3 Examinations

The main issue for all participants, without exception is the way that IWCF phrases the questions. Even those who are British and grew up and received most of their education in the UK or Scotland from there had some difficulty with the questions. They all agreed that the way IWCF words the questions is very confusing or "tricky and mangled," and the questions could easily be misinterpreted. They claimed that even though English is their first language, they still had to read the question many times to try understand what the question is about and which choice they must select. It frustrated them because they believe there is no point in tricking them, especially in a test situation where every second counts.

Another significant obstacle for all participants was not being able to see their mistakes on the tests. According to IWCF rules, candidates cannot see their test papers and their mistakes on the tests after the invigilator marks them. Therefore, they do not know exactly what their weak points were, so they can work on them and improve themselves. All that they can see is their grading sheet and grading analysis sheet that show the concept of the questions for which they failed to provide the correct answers. For example, if the candidate answered question number 10 wrong, from the grading sheet a candidate would know that he/she lost four points on that question and from the grading analysis sheet he/she would know the concept of that question is about, for example, "formation pressure." That is all the candidates know about their tests

results. They reported wishing that they could see their test paper to know what the format of the question was and review the choices to know why the choice they made was incorrect.

Three of the seasoned participants two from surface supervisor level and one from combined surface and subsea supervisor level, stated that they had taken this training 10 -16 times and they have no problem with the math or calculations. Their level of knowledge of drilling operations in general and well control in particular is very advanced. However, they suffer "exam anxiety" and they are overwhelmed with stress and panic. So, if they miss answering any question, or if they answer it wrong, that does not mean they do not know the answer, rather they just missed it because they were anxious. The participant from combined surface and subsea supervisor level pointed out that factors such as age and job responsibility have an impact on achieving the IWCF certification. He is 62 years old and he had taken this course 16 times. According to him, being a consultant for 25 years means that he has to give accurate and valid recommendations, therefore, he always takes the required time to read any document before he gives his opinion. At his age, he still applies this approach to the IWCF test as well, but knowing that he is in a test situation and there is an invigilator "staring at them all the time" his anxiety level increases.

The respondents at supervisor levels from both surface and combined surface and subsea endorsements stated that passing the IWCF tests with high marks is another type of pressure that they carry on their shoulders when they attend IWCF training. On one hand, achieving high marks will help their crews to look up to them as "role models." On the other hand, if something goes wrong on the rig site, the supervisors are the ones who will be questioned first. Therefore,

they have to ensure that their calculations are accurate and everything is documented according to the company policy because “nobody wants to go to jail.”

In contrast, only four of the participants believed that renewal of the IWCF certification should be every three years instead of two years. This is both for the convenience factor and for not having to take time away from their lives and families to renew the certificate so frequently. They claimed that the training fills in their days off, so if they have four weeks off, then they lose one week to the training. While another four of the participants who had taken the training more than ten times wished that decision makers at IWCF would reconsider the option of “challenging the test” by allows them to write the test without attending the training. They believe that their level of experience and training is advanced enough to challenge the test.

In contrast, a participant from surface supervisor level who had 27 years of international work experience and seven years of Canadian experience pointed out that candidates who complain that they have to renew their certificate every two years do not want to admit that they do not know as much as they think. He also mentioned that he had taken IWCF training around 13 times and every time the course updates his information and reminds him of some information that he might have forgotten because of disuse. Furthermore, he reported always wanting to achieve high marks on the three components of the IWCF examinations for his own personal self-satisfaction even though he was 60 years of age.

The four participants who worked in Canada on Shell and Seadrill projects were between 42-58 years old, and they all worked for drilling contractors. They claimed that their company offended them by forcing them to take this training. They believed that their field experience made them over-qualified to manage Shell and Seadrill projects. My interpretation for this

attitude is that they are confident in their knowledge and experience. Therefore, they believed that IWCF training will not increase their knowledge or improve them. Likewise, according to the industry legislation in Canada, drilling personnel must hold either First Line or Second Line certification. So, since these participants started working on the rig, they had already obtained a First Line and then a Second Line certificate, therefore they think they are well-trained. In addition, when IWCF training was introduced to them, they rejected it because it is new to them and it might intimidate them.

4.9 Main Work Barriers and Building Safety Leadership Skills

This section explores the subquestion: "What are the main barriers that prevent drilling personnel from mastering their leadership roles on the rig site?" The analysis of the qualitative data presents the following five main barriers: working with locals, language, working with engineers, different age generations, and educational barriers. The discussion will then focus on the main barriers that prevent the participants from mastering their responsibilities as safety leaders.

4.9.1 Working with locals

Most international rigs have a percentage of 40% - 50% locals who hold different positions. Working with locals is not an issue, according to 33 participants. They actually enjoy working with locals and learning new languages and cultures. However, they stated that the key factor to working with locals is to be open-minded to accept different ideas and opinions. Based on the participants' work experience with locals, they described them as hard workers who are eager to learn new things to improve their level of knowledge and skills. For example, a "language trade" is a well-known approach in the international oil & gas industry. Locals who

have low-to-intermediate levels of English always want to improve their English skills, especially the ones in roughneck and assistant driller positions so they can be promoted more easily. Therefore, they make a deal with native speakers of English. The deal is simply locals teach foreign workers the local language and foreign workers teach locals the English language.

Likewise, one of the surface supervisors shared with me his own experience with a "language trade" approach. He mentioned that one of his local drillers in Brazil asked him to spend an hour a day to allow him to speak English and to correct his pronunciation, and he did the same in return in Portuguese.

All participants from the combined surface and subsea supervisor level stated that locals want to move up to a higher position with their career but they give themselves time to learn each position's requirements. They work hard to develop their skills by listening to their supervisors instructions and to gain further qualifications to move up the career ladder, but they take it slowly and step-by-step. On the other hand, they believe that young Canadian personnel who work on international drilling rigs are both smart and conceited at the same time. They want to complete their job tasks quickly and they want to move up the career ladder, but they do not want to put in much time and effort to learning because they think "they know it all."

In addition, one of the respondents at the combined surface and subsea supervisor level mentioned that working with locals reminded him of his work experience with the Newfoundlanders. He mentioned that when the Newfoundlanders came to Alberta to work on drilling rigs in the 70s when it froze up in Newfoundland, they were the best workers at that time. They were there just to work and they were the most cautious and safe workers to be around.

4.9.2 Language barriers

Working with locals for whom English is not their first language might affect maintaining safety on the drilling rigs. The following discussion sheds light on identifying the consequences of language barriers and how participants overcome this barrier.

English is the universal language in the oil field. On most international rigs, there are some locals who have an intermediate level of English. There is always one or two local drillers who can speak both languages and they can interpret back and forth. Through these bilinguals, foreign workers can communicate with locals. All participants indicate that they can pick up the language in the time they are there, especially by using the "language trade" approach so they can have basic communication with those who do not speak English. Furthermore, they stress that showing respect for the local culture and religion helped them to close the gap between them and local workers.

All nine participants who work in the Middle East stated that they have not faced any language barrier because everyone spoke English on the rig. That could be simply justified because almost everyone up to a derrickman on the rig understands and speaks English. In the Middle East, the British and Americans were the first investors in the Persian Gulf States in 1908. So, the English language was introduced to the locals who started working in the oil and gas industry more than a century ago. Since then, the English language has been used on the drilling sites in the Middle East. Since they have started to hire more locals and provide job opportunities as a part of the agreement with the government in the Persian Gulf States. At the beginning, they used interpreters to communicate with locals, so many generations of these locals have worked on the rigs under the supervision of native speakers of English. Of course,

they learned some English skills and they tried to develop these skills along with their other job skills. Furthermore, the public education system in the Persian Gulf States now mandates learning English language from grade five in some states as Kuwait or grade six as in Saudi and the UAE. As a result, on each drilling site there are a few locals who speak intermediate to fluent levels of English, especially those who are directly involved in the drilling operations such as drillers. We could generalize the above facts to other parts of the world where the British and American investors are.

However, working in Vietnam, where the English level among workers is low, the two participants who worked there mentioned that they overcome this barrier by giving them basic instructions about what they really need to do, but no more than that. Otherwise, the locals will get confused and return to their supervisor to clarify what they are supposed to do. So, the most successful method that they use in this case is to lead by example. They have to demonstrate to the national workers first how to do the job several times at the start, then they just let them do it under their supervision. However, if the oil company or the drilling contractor found that some locals do not have the required qualifications to be a driller, for example they can replace him/her with a foreign worker. They can justify this to the government as these qualifications are safety related in some perspectives.

In contrast, two of the participants at surface driller level who worked in Australia mention that they experienced a language barrier working with Australians. According to them, Australians “do not speak proper English” and they use a lot of “*slang*” and terminologies different from Canadian English. I believe that these two participants have faced this kind of

language barrier while they were working with native speakers of English because this was their first time working outside of Canada and they had never traveled overseas.

Most significantly, when English is not the first language where the operations take place, all safety meetings are conducted in the local language first, then in English. On nearly every international rig there is an interpreter to accommodate the foreign workers if they need to talk to locals. Usually the safety officer speaks both languages. Nowadays, a lot of locals speak English on the rigs. However all participants state that math speaks for itself and all locals understand math and are good at it.

In addition, the participants who work in Brazil mentioned that they have a language coach on the rig floor who speaks Portuguese and English, but does not have drilling background. He is able to interface between the rig crews to explain what they should and should not do, but if there is any misunderstanding, especially at critical tasks they definitely make sure that everybody understands before they proceed.

However, all participants pointed out that most locals seem to realise that English is the dominant language in the oil and gas industry, and if they want to progress they need to have English skills. Nowadays, most international rigs provide English training courses for locals to raise their English level. They can become international staff in the future if they are good enough in their job. So, by providing English language instruction, the quality of work environment improved because the workers already understand both the math and the equipment.

Two of the seasoned combined surface and subsea supervisors had different perceptions regarding language barriers. They mentioned that, as in any industry, the oil and gas industry has specific terms for everything and its own jargon, and even people with an English background do

not know these terms. If they hire new employees, they have to learn these terms, regardless of the language they speak. That means they have to start from the beginning with everybody, and people with no English background they can learn this very easily. They stressed that as a leader, they had to establish communication before they started an operation. Certainly they have faced some difficulties when they start working with new locals, because they have to learn how to understand them first. In order to achieve this, they use body language with non-English speakers. They also have had to slow the speed of operations and have more frequent safety meetings and with more explanation. Once they have worked with them for few weeks, they get to know each other, and because the locals are eager to learn, that makes the communication process a lot easier.

4.9.3 Working with engineers

According to 25 participants, dealing with engineers is "a nightmare" and the most difficult part of their daily job. They stated that there were some communication issues with engineers. On one hand, the 22 out of the 25 participants mentioned that people from the field even though they have technical knowledge, need a certain level of education so they can meet with the engineers on some level. On the other hand, the participants argued that the engineers should also be required to have a certain amount of time in the field so they can have a better understanding of the field personnel and meet with them on the same as well.

The participants from the surface driller level indicated that there was a lot of clashing between engineers and those with less education, because engineers think their way is the only correct way to complete the task. However, when the engineers go out to the field they lose their superiority because they cannot always transfer their book knowledge to the field. So, the

participants from this category believe that without experience, the degree means nothing. Moreover, the reason behind the gaps in communication between engineers and rig personnel is that engineers do not use the language that the rig personnel speak on the site, and they are not actually aware of the reality. It is hard for them to understand the situations that the rig personnel face on the rig site without field experience.

Furthermore, the surface drillers argued that engineers are ignorant and look down on drillers who are not as well-educated. One of the seasoned drillers pointed out that when the drilling engineers first meet the drillers, they do not give them enough respect, but once they get to know them they change the way they deal with them. The engineers will then say "this guy knows what he's doing and he is confident in what he's doing." However, he added that when the engineers are close in age to the rest of the team it bridges part of this gap.

From a surface supervisor's perspective, eight participants from this category argued that there was a gap in communication with the newer engineers that have just come out of school because they do not have real practical experience in the drilling environment. Also, the older engineers that are out in the field may not have the experience that the rig personnel have, but at least they have the experience of being there, and learning a lot, and gaining practical experience. The participants stressed that they can build good relationships with older engineers based on better understanding and communication. While older engineers know that the rig personnel might not have the education that they have, they believe in the workers and their experience and know that education and experience are both important.

However, some surface drillers pointed out that while everything may look good on paper, sometimes engineers do not understand that there are other factors that affect the

application of their ideas. For example, human, environmental, and equipment factors all play major roles in the actual operations. Engineers can create wonderful ideas to complete the operations in the exact planned time and to reduce the cost, but they may neglect the other factors. Taking these factors into consideration, explains why sometimes rig personnel have to slow the operations. Therefore, engineers need more practical experience so they can understand why it is sometimes hard to follow the scheduled plans. One of these participants who works for a drilling contractor on Shell projects stated that, "Some engineers can really remember the whole entire book like an encyclopedia in their head, but with that good information they can't walk around on their own two feet."

On the other hand, three of combined surface and subsea drillers indicated that they could easily communicate with the engineers due to age similarities between them. They pointed out that because a lot of their engineers have just graduated from school, they do not know the equipment but they know the math and a lot of the procedures. As a result, they complement each other and their achievements are due to working as a team.

All five engineers who participated in this research started their career in the drilling industry from the bottom up. Therefore, they knew how to communicate with the rig crews because they had initially started on the rig as roughnecks. They added that, to this day they still have more experience on the rig than they have off the rig. Therefore, they have not had any problems communicating with the personnel on the rigs. They also stated that people that only have academic experience do often have some problems relating to the personnel at the field level and they have seen many scenarios of conflict between rig personnel and new engineers over certain procedures. They all indicated that some of their drillers and rig mangers who can

barely read and write and may only have grade eight or grade nine education are nonetheless the smartest drillers when it comes to problem solving and leadership. These drillers and supervisors have gained that knowledge the hard way, and not from formal classroom settings. Nevertheless, one of the engineers who attended IWCF training at surface supervisor level, always tells his crew that, "without each of them the whole place would go to hell. We all are important." So, someone's education is not a limiting factor or a barrier to communication when getting anything done on the rig site.

4.9.4 Different age generations

Surface drillers indicated that working with employees from different generations could be a challenge sometimes. Leaders must prepare the ground to communicate with their crews by using their preferred method of communication. For example, they do not communicate with the older generation electronically unless they are certain they actually have the ability to communicate in that way. Typically, communicating with older crews members should be either via phone or face-to-face.

According to the four surface supervisors who work in Canada younger generations have come to this industry seeking quick wealth. The participants reported that young workers think that within a year they will have the biggest truck, the nicest house, and many other luxuries, but they do not have the patience that drilling activities require. Also, they stated that younger generations do not think about a career at only one company. They usually think, "I'm going to be here maybe three years, then I am going to move to something different." The older generation, however tends to think, "I'm probably going to be at this company for maybe my

whole career." There are indeed different expectations and goals between these two generations. This finding is similar to Houser's (2010) study finding in relation to the oilfield workers who accept this kind of physical work just for the money, because they can make "high wages relatively quickly."

Other surface supervisors claimed that some of the older generation do not want to learn or change and may be "stubborn" or "stuck in the middle." In contrast, the young generation has no patience because it has not been trained as the older generation has. Yet, these participants believe that both generations are good workers, and they realize that the industry needs the older generations to train the younger generations in the proper work procedures. They want the younger generations to learn patience and be aware of the consequences of unsafe behaviour.

Combined surface and subsea drillers suggested that the difference in age between crew members creates an issue sometimes. Older crews have more experience than younger crews and they understand the risks and hazards associated with their job and on daily tasks. The participants all generally prefer to work with older crews because they are more mature and experienced. Accordingly, it makes their role as supervisors easier because they can just focus on the well and drilling operations, whereas when they work with younger crews their attention is divided between monitoring these crews and focusing on drilling operations. They believe that working with younger crews is more time consuming because they have to make sure certain tasks are being completed and all paper work is properly filled out.

All participants from the combined surface and subsea supervisor level stated that, on the one hand the older generation are straightforward when they work and they have made a lot of sacrifices to build their personality and career. On the other hand, the younger generation wants

everything done quickly and they still need to develop more patience. They must also respect the senior crew members and understand that the more experience a person has, the more responsibility a person has. Furthermore, the younger generation has to spend time getting practical experience if they want to go further with their career even if they already have the education.

4.9.5 Educational barriers

All participants from the four categories agreed that the industry needs people that have more hands on experience than higher education, because they have common sense and are less likely to get injured. Experience likely plays a large role in maintaining safety in the drilling industry. From a practical perspective, most drilling operations are physical labor jobs, so the industry does not really need a lot of education for that kind of job. Most of the drillers do not need a degree to operate or perform their job. All that they need is high school or even a grade ten education so that they can do basic calculations.

However, there were some participants who also indicated that the industry needs each individual to have both experience and education. They claimed that a combination of education and experience will help a person better understand the operations and safety procedures. In fact, the majority of rig personnel have grade 12 education or less, as mentioned earlier in this chapter, but they get their education from doing courses such as First Line, Second Line, IWCF, as well as nontechnical training. All kinds of training, whether it is a technical or nontechnical, could be considered continuing education for the drilling crews who have high school or less.

Generally all participants agreed that more education is always good, but there are two ways to do it. Either they can go to school and learn everything on paper or by go out to the field and learn it according to the "old school" way of doing things. Working together will really bridge the gap between the textbook and field experience and make a good combination. The overall perception among respondents is that the industry definitely needs more experienced people because engineers do not fully understand the operations, but are the ones who make the decisions. These decisions do not always work out in the field, and that is why they think "book smart people don't have the thinking capability." The formally educated crew members may understand the technical parts of the drilling operations, whereas the personnel that have been out in the field better understand exactly what is going on down holes, how to crunch the numbers, and understand basic theories. Nevertheless, there is no doubt that the industry needs educated people. Education goes a long way as well, but the practical experience especially on the drilling site, is very crucial. Therefore, helping each other understand their strengths will bridge the gap and remove some obstacles because together these crew members are conducting many millions of dollars worth of operations a day.

Eight of the respondents at the surface supervisor level argued that no matter what level of education the rig personnel have, it is all about quality and knowing the personal weaknesses of those with whom they work. They claimed that when they choose their crews, education is not so much of a consideration. Work ethic, a positive attitude, and willingness to learn are more important. They prefer to take someone who is willing to learn and wants to be good at their job over someone that may know all the formulas and calculations but might not have such a positive work attitude.

From the above perspective, two of the seasoned combined surface and subsea drillers stated that the best workers come with some work experience, although it does not have to be in the drilling industry. For example fishery and construction workers are good candidates to work on drilling sites because they know how to work. When they come to the field they do not know anything technical, but because they are used to physical work they make remarkable progress. Whereas younger personnel who just came right out of school and have never actually had a job before do not know what hard work means. They have to teach them how to work before they can teach their job responsibilities. They also added that younger offshore personnel think that they are going to stay clean, it is going to be nice and quiet, and every day is going to be the same. They do not want to work when it is raining. They want to go inside and wait until the rain stops. Therefore, these supervisors need to reset their younger crew members expectations.

Another significant result regarding the educational barrier is that there is a generation gap between those who grew up in the computer age and those who grew up with pen and paper. This gap creates some communication conflict between these two generations. However, they both believe that they have to talk and meet in the middle so they can get the job done. The old generation realizes the importance of education, especially now with all the training courses. So, they know that they need more knowledge now than back in the old days where "hands on experience" was the only requirement. Nowadays everything is computerized so they have to learn how to deal with it.

Finally, all respondents at the combined surface and subsea supervisor level stated that the big step to limiting the differences in education between crews is by establishing a safety

culture and reinforcing good behaviour and good habits. This would help personnel make the way they do business and how they conduct themselves a part of their lifestyle.

4.10 Discussion

This discussion aims to answer the overarching research question: "What is the relationship between IWCF Rotary Drilling Well Control Training Program and developing safety leadership skills among onshore and offshore drilling personnel?" As well as to summarize the research findings.

Eight of the participants at the surface driller level reported that IWCF can develop their ability to use observation cards to help their crews better understand a hazard that has been identified. They also believe if the sort of training IWCF provides does not change a person's unsafe behaviour, that person should not work on the drilling floor. Furthermore, they argue that even though this training might have the ability to develop safety leadership skills, nonetheless the most effective way to improve these skills for both drillers and supervisors is to lead by example. They point out that leading by example includes setting standards to be followed and simulating a real life situation to help the crews understand safety procedures.

In addition, they believe if each member of the drilling crew took IWCF training, that does not necessary mean they will agree on the same procedures, because each operation can be done in many different ways. Therefore, IWCF policy makers need to take into consideration that each member comes from different drilling backgrounds and industries. In addition, the majority of candidates do not have the North Sea experience and not each oil company follows the Norwegian standards.

However, the other two respondents at the surface driller level stated that IWCF cannot make them good leaders because, according to them, leadership is what each individual brings on their own. They claimed that taking this course is not going to make them leaders. Leadership is a natural ability that develops with a person as they grow up and it is a combination of how their parents raised them and their own work ethic. They believe that some people are "born to be leaders."

According to 70% of the surface supervisor participants, IWCF training is good because it allows crews, especially the younger ones, to have a better understanding of the theories behind well control operations and helps them to think about the situations they may face. If these crews kept constantly taking IWCF training, their competence level would improve from just having the knowledge of well control operations and the understanding of why and how well control operations happen. Likewise, this training has the potential to develop safety leadership skills because, as leaders, they must have an overview of what the crews are doing out there on the drilling floor. They have to ensure they are not cutting corners, and that means leaders must be familiar with the proper procedures. If the crews proceed to any operation by taking shortcuts, leaders must correct them and warn them of the consequences of their potentially unsafe action. Yet, there are some supervisors who took the training many times and hold several certificates, who take some shortcuts to speed the operations in order to be named the fastest crew leader. This type of supervisor has only one goal, namely, to get promoted to a higher position, but this is not a good approach to safety.

At 20%, a minority of surface supervisor participants said that while this training will increase the safety knowledge in well control situations, it will not improve the safety of other

drilling operations. They also stated that due to the fact that they will be more confident in well control situations, they will perhaps become more proactive than reactive and more cautious in other drilling operations. In this regards, one of the surface supervisor participants who remarked that

> IWCF will improve their safety skills and awareness relative to well control operations, but it is going to have a limited effect on the rest of the safety skills that are relative to well drilling operations. Because well control operations are only part of working on drilling rigs, moving tools and drilling pipe around, lifting and slinging loads have nothing to do with well control. So, IWCF has a significant impact on well control safety awareness, but not so much on the rest of drilling operations. So, the impact of IWCF on the overall safety is fairly small because realistically, only 10% of the drilling crews have IWCF certification. IWCF certification cannot improve overall drilling safety skills, however proper safety procedures and proper well control procedures will have an impact on productivity by preventing incidents from happening.

Conversely, 10% of the surface supervisor participants stated that IWCF cannot develop safety leadership skills and it only develops the knowledge of well control. They claimed that this is the only benefit of this course.

All surface participants agreed that making IWCF certificate a requirement is not going to unify the equipment, the principles, or the procedures, because the equipment and procedures are different from one drilling rig to another, and some companies go above and beyond with reference to safety procedures. There is a wide range of everything and operating in different countries is another mitigating factor. For example, in Canada one worries about freezing, whereas in Africa one worries about the heat. So, to have one universal manual will not address the needs across the drilling industry.

According to the respondents at the combined surface and subsea driller and supervisor levels, IWCF training makes people fully understand the risk of what can go wrong and how to

maintain blowout preventer (BOP) equipment. If they take that information and go back and practice it, then that information becomes knowledge and increased competence for them. From the above perspective, IWCF training could improve safety leadership skills. Furthermore, this training will improve leadership skills among trainees because they will be more competent in their job and in the decisions they make. IWCF training also increases the safety awareness by giving them a better understanding of the rig and of the actions or the reactions of the well with respect to BOP considerations, the equipment, and safety procedures.

Likewise, the participants reported that IWCF training also has a positive impact on developing leadership skills because as a leader "you have to lead from the front and lead by example." So, the followers will see what their leader is doing and they try to copy them and learn to get better at their job. A leader must explain and enforce the reasoning of why they should or should not do certain procedures, and IWCF training helps them do this. A combined surface and subsea supervisor participant remarked that "leadership skills are something that a person builds over their life as they go along. Personally, IWCF certification can help with reference to building the safety awareness by knowing the proper safety procedures, because in fact IWCF is nothing but safety and well integrity."

A combined surface and subsea supervisor stated that after twenty years in the drilling field he still has all his fingers and toes, and everybody that has worked with him has their fingers and toes, because he has that type of safety awareness that he has built throughout his career. He claimed that the above achievement is a great example of his safety leadership style. He also added that building that type of safety leadership requires a lot of hard work, a lot of ups and downs, and a lot of sacrifices to get to his current position.

All five engineers agreed that using IWCF training to build safety leadership skills depends on who is teaching the course and what the instructor's attitude is towards it. Safety training gives personnel the tools, but it is up to them to have the mindset that they are going to use these tools and operate them safely. IWCF training is well control related; this is almost one of the biggest hazards in the drilling industry so definitely it is an essential tool. To some extent IWCF likely has the ability to develop safety leadership skills. Once someone has an IWCF certificate he is picked as a leader because in order to be in charge he must be certified. Although, IWCF does not train one to be a leader, by taking this course a person can obviously be trained to control a well and understand the equipment.

As a result, IWCF training assists them in better understanding the people they work with and establishing some of leadership qualities. It refreshes their memory and they become better at figuring out formulas more quickly than before, so it does positively change the drilling personnel. The various discussions that the participants had in the classroom prove that. In particular, when one of the candidates cannot understand a certain concept, the other candidates start an open discussion to explain that concept in a simpler and more practical way based on their experience. During these kinds of discussions they go through many details, affirming that these candidates are knowledgeable of well control operations. So, safety-wise IWCF training can improve safety leadership skills. When they deal with any dangerous or complicated well control situation with confidence and understanding of what the safe and required procedures are, there is inherent safety thought in that well control situation.

Another significant finding is that there are some differences between surface and combined surface and subsea participants with relation to IWCF training. From my work

experience at IOTS and from conducting the research interviews, I have noticed that the candidates from these two endorsements are different in some aspects. For example, combined surface and subsea candidates are willing to share more information and details about their work experience. That also applies only to seasoned surface candidates who have more overseas work experience than local experience. Combined surface and subsea candidates are typically open-minded toward IWCF training, even though they have the required experience to manage well control situations. They look at IWCF training as a good opportunity to refresh their memory and to benefit from other candidates' work experience.

Furthermore, all combined surface and subsea respondents, and 80% of the surface respondents, value the discussions that they have in the classroom with the other candidates and the instructor. I have observed some of these discussions where almost everyone was engaged in the discussion and gave some examples of similar situations they have experienced on their rig site. Even the IWCF instructor at IOTS, Mr. James, himself believes he benefits from these types of discussions. According to him, he can use the examples the candidates give to enrich his instruction and connect it to future IWCF concept that are scheduled on the course outlines. Because Mr. James works as a drilling consultant as well, he claimed that he benefits from these discussions, and when his international clients ask for his opinion he always says, "one of my students said they do such and such when they have this situation so how about you try that," and he will give some certain directions to follow his recommendations, just as the candidates mentioned in class. Furthermore, sometimes when the class has had this kind of discussion, I have heard Mr. James mentions for example, "last week one of the students gave us some good reasons to use the Wait & Weight method instead of the Driller's method. I have recently started

to recommend this method to some companies because of these reasons." Then the discussion took a very interesting direction and everyone wanted to share their opinions.

My impression is that 90% of combined surface and subsea candidates were more positive candidates. During the interviews I sensed their desire to develop skills and forward their career, especially from the younger participants. One of these younger participants called IWCF training a "learning curve" because it is difficult to pass but also crucial to his career. The first time he took it was very challenging and he barely achieved 70%, but because he enjoys his job and he wants to get better at it, he decided to learn it on his own. He told me that he took his IWCF manual with him to work to study whenever he had free time. If there is anything he could not understand, he asked his colleagues or the site drilling engineer until he fully understood the theoretical aspects behind the IWCF well control course. The next time he took the course, he felt more confident because he had built the foundations to receive new knowledge and connect it to his previous knowledge.

On the basis of remarks like those above, the IWCF Rotary Drilling Well Control 3 &4 level training appears to be effective for adult learners at both driller and supervisor levels. Candidates from both levels must have some drilling experience, therefore they are familiar with well control, even if they have never experienced taking a kick. However, being knowledgeable about drilling operations will help them to receive new knowledge about well control. It is then up to them to find a way to connect their drilling knowledge to new well control knowledge. There many, especially younger candidates, who find it difficult to make this connection between new and prior knowledge. Nevertheless, the more experience they have, the more easily they can build bridges between these two kinds of knowledge. This learning style is based on

adult learning principles because adults construct their learning by bringing life experiences and knowledge to the new learning experiences.

Another significant difference between surface and combined surface and subsea participants that is drawn to my attention, is with regard to their attitude toward IWCF training in the perception of safety. I believe that working offshore on a drillship or on a jackup make offshore personnel value and appreciate life more than onshore personnel. Of course, life is very important to every human being, but working offshore in a very isolated area forces these personnel to be more cautious. My supportive reasons behind this belief are (a) they respect and follow safety policies and legislation, (b) they consider safety as a value and not just a behaviour, (c) they are aware of the offshore expenses, and (d) they watch out for each other to avoid or reduce injury, because they knew that if someone is injured it might take time to get a rescue helicopter depending on their rig location. One of most remarkable stories that one of combined surface and subsea drillers shared with me is that

> I learned an unforgettable and powerful safety lesson about the importance of being a safe worker from my supervisor. One day we were dealing with a gas kick and I and another driller were on the rig floor, I had unsafe behaviour that could cause a disaster and might kill my colleague who was standing beside me. After my supervisor directed us to what we were supposed to do and after things were back to normal he pulled me aside and explained to me why my behavior is considered dangerous and might kill my colleague. He asked me to go back to my room and pretend that my unsafe behaviour killed my colleague. Then he told me to write a letter to my colleague's mother to tell her in details how my stupid selfish behavior killed her son.

One of the most significant differences that related to the positive attitude toward the training is the participants themselves and their birthplace or homeland. I noticed that all participants who attended the training at St. John's centre are from Newfoundland (NL), Nova

Scotia (NS), and New Brunswick (NB). While the ones who were at Calgary centre are from Alberta (AB), British Columbia (BC), and Quebec (QC). That is mainly because most of the participants work internationally and they schedule their training to be taken at the first week of their time off. Therefore, they attend training at the closest centre to their hometown to avoid extra travelling after they finish. I realized that the participants from the Maritime Provinces are delighted and excited to take the training, even if they have some difficulties with math and memorizing the equipment components. They always ask the instructor for extra exercises to practice and they stay after the class to do their assignments in case they need the instructor's help. According to Mr. James, Maritimers are "positive people." He enjoys his class in St. John's more than the Calgary because the participants are flexible and easy to deal with. They are honoured to take a week from their time off to take the training. They are more relaxed, whereas some participants who attend the Calgary course "beat themselves up" the whole week. The East Coasters highly appreciate that their company covers all the training expenses and they want to achieve high marks as kind of acknowledgment for their companies. If they fail, they want to cover the resit fees because they believe that they have disappointed their supervisors and company.

By conducting this research, I have realised that the majority of the participants are dependent on their experience to successfully approach IWCF training. They all, without exception, answered the interviews questions by making a connection between the theory that they take in the classroom and their work practices. I strongly believe that if they did not have this work experience background they would not be able to manage this training or even enjoy learning it.

However, I would highly recommend that IWCF policy and decision makers emphasize the importance of the practical assessment and give it more value, because that would benefit the young personnel, especially the one at beginner levels such as assistant drillers. There is no doubt that the drilling operations need personnel who have richer experience to manage and recognize any changes that might cause a blowout or any other rig disasters, but this experience does not require a high level of education. Around 70% of rig personnel have high school level of education or less. However, having grade ten math skills is adequate to complete the basic calculations that they need to track the operations. Therefore, a formal classroom setting may not be the most effective method for an industry that employs people with practical experience. Nevertheless, they can still attend IWCF training if they use the simulator exercise to cover the equipment and principles and procedures modules. That would require building solid foundations of IWCF training by providing more comprehensive well control scenarios to simulate real-life drilling operations and allowing more interaction opportunities between crew members in various rig functions, especially the ones that deal with well control scenarios. Likewise, giving more value to the simulator practices during IWCF training could help provide the essential knowledge and job related skills which drilling personnel need to handle well control situations with a high level of competency.

From the evidence of the above research results, using a computer-based drilling live well simulator that provides a combination of practical, hands-on-training and theoretical explanations is a more beneficial approach than just a formal classroom setting. That could be easily justified because adults learn better by doing and they like to be given the opportunity to use their existing knowledge and life experience, and apply it to their new learning experiences.

As noted in Chapter Two Schubert (1999) and Hodgson & Hassard (2006) recommended using the simulator to train personnel in some particular drilling procedures. Moreover, adults are typically more internally motivated, therefore IWCF training can use this principle to build learning activities and scenarios that motivate learners to learn and strengthen their knowledge.

4.11 Chapter Summary

In this chapter I presented the results and the analysis of 40 semi-structured interviews. I also provided the major themes that emerged from the analysis of the qualitative data. Then I provided my interpretation and discussion with reference to the participants' perceptions of the relationship between technical training such as the IWCF Rotary Drilling Well Control training and developing safety leadership skills.

Chapter Five: **SUMMARY AND CONCLUSION**

5.1 Introduction

This study aimed at investigating the relationship between the International Well Control Forum (IWCF) Rotary Drilling Well Control Training Program and developing safety leadership skills among onshore and offshore drilling personnel. In order to achieve this investigation a semi-structured interview approach was conducted with 40 onshore and offshore participants, with ten of each of the following categories: surface driller, surface supervisor, combined surface and subsea driller, and combined surface and subsea supervisor. The main goal of these interviews was to collect data to answer the overarching research question "What is the relationship between technical training and developing safety leadership skills?"

Eight significant themes, as figure 5.1 shows, arose out of this study to answer the research questions to determine whether or not there is a relationship between IWCF training as a technical training program and developing safety leadership skills.

Figure 5.1 Emergent Themes in the Current Study

In brief, the study highlights the positive relationship between IWCF Rotary Drilling Well Control Training Program and developing safety leadership skills among onshore and offshore drilling personnel. Even though it underlines the impact related to well control situations, about 70% of the participants indicated that this impact could be transferred to other drilling operations. 25% of the participants indicated that this transfer depends on the individuals themselves and how they interpret and integrate safety when they lead their team. The other 5 % reported that technical training cannot develop nontechnical skills at all.

The interpretation of the results and the discussion that provided in Chapter Four lead to a range of suggestions for the areas of and individuals in the international oil and gas industry, safety legislation for both oil companies and drilling contractors, decisions and policies makers

at IWCF, onshore and offshore drilling personnel, and IWCF training providers. These implications are summarized in figure 5.2.

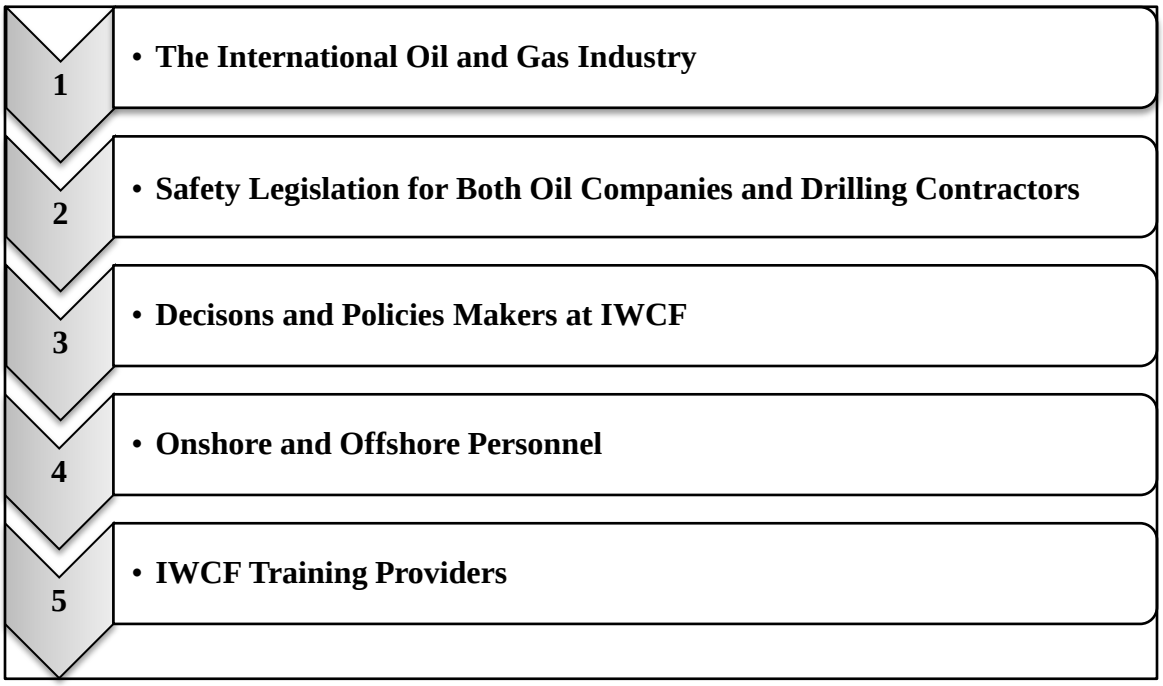


Figure 5.2 Implications of the Study

On one hand, the urgency of the response to implement these suggestions is crucial because the need for standardized well control training must be started from the ground up in the oil and gas industry. On the other hand, the urgency cannot be understood because of the rapid improvement in the oil and gas sector, especially the development of the technology and equipment. However, I strongly believe that the international oil and gas industry must take the initiative to set up the foundations for standardizing well control exanimations and certifications. The following discussion of the implications presents the suggestions associated with these implications in the order as seen in figure 5.2.

5.2 The International Oil and Gas Industry Implications

The international oil and gas industry has the power to influence the required standards that drilling personnel performance must meet in order to work on onshore and offshore drilling sites. Standardizing well control might be an urgent need as Chapter One described, but it is also the appropriate approach to avoid or reduce deadly minor and major accidents. That is because standardizing well control training will create a mutual understanding among drilling crews, especially in the 21st century, where the oil and gas industry is becoming globally unified. Many workers have worked for many different employers around the world. Even though the findings indicate that the equipment and procedures vary from company to company, the basic drilling principles and procedures are the same. So, if standardizing well control training focuses on the basics and mandates them, this might help the industry to avoid and reduce deadly accidents, both those officially filed and those not.

Furthermore, Oil and Gas Producers (OGP) Report No. 476 published in 2012 is nothing but a significant example of the international oil and gas industry's efforts to emphasize the importance of standardizing well control training. By continually offering these recommendations and updating them accordingly for newly invented technology and equipment, competent authorities will be able to provide accredited well control training programs according to these recommendations.

5.3 Safety Legislation for Both Oil Companies and Drilling Contractors Implications

Both oil companies and drilling contractors must communicate with each other and with worldwide well control training organizations, namely IWCF and IADC. This communication aims at establishing solid foundations with reference to having unified basic safety legislation

and the type of performance skills that their personnel really need. Likewise, when all oil companies and drilling contractors have the same basic safety legislation, they will have to accept both IWCF and IADC certificates, as they are the most well-known internationally recognised certificates in the industry.

For instance, if a new employee holds one of these two certificates, the employer should let them perform their job and once this certificate has expired the employer can ask them either to renew it or obtain the other one. This action is justifiable, especially after both IWCF and IADC organizations have responded to OGP report No. 476 (2012) recommendations and revised their well control training program objectives to meet with these recommendations. Theoretically, both training programs have the same objectives, therefore oil companies and drilling contractors should give the same respect and value to both certificates.

Communication among IWCF, IADC, oil companies, and drilling contractors must be continually enhanced for effective results that benefit the international oil and gas industry and its personnel. This could be simply achieved if the oil companies and drilling contractors offer professional technical opinions related to drilling operations, principles and procedures, new technology, and equipment that they use in the field. In return, IWCF and IADC organizations can then integrate the provided knowledge into their training programs. These cooperative efforts will certainly raise the competence level among drilling personnel. Moreover these efforts can familiarize new personnel with the training instead of having that "initial shock" when they attend the training for the first time.

Most significantly, all of these efforts could go "down the drain" if the oil companies and drilling contractors do not believe in the importance of the training itself, not just holding the

certification, and there is a fine line between these two aspects. The oil companies and drilling contractors recognise the significance of the training itself to improve their personnel skills. However, if they believe that their personnel must be certified just to prove their level of competence to the insurance company, they will give their personnel the impression to that they can take the training lightly and value only the certificate.

5.4 IWCF Implications

This suggestion targets the worldwide associations that represent the oil and gas drilling industry and specialize in designing accredited programs that are recognized throughout the world, namely IWCF and IADC. Both these two organizations have responded to OGP Report No. 476 and updated their accredited training programs and issued a new syllabus and course objectives to meet OGP recommendations and to recognize the industry standards. IWCF and IADC can help develop safety leadership skills by integrating some influence to present each crew member's role that is taken in certain situations. Then the instructors who teach these programs must emphasize the importance of following these roles description.

Mandating each drilling member to have a well control certificate, such as those promoted by one of the above organizations, will enhance safety culture through training. In order to achieve this goal, IWCF and IADC decision and policy makers could intentionally embed nontechnical skills such as leadership, communication, and risk awareness into the program objectives, because they are the most influencing skills that might improve the safety culture. Most significantly, it is crucial for any oil company to have safety leaders at every job site. However, if we believe that each individual in the organization is a safety leader, then all

personnel must be competent at their jobs. Being competent means having the ability to identify hazards and to be aware of the risks associated with each operation.

Most significantly, to ensure that drilling personnel greatly benefit from well control training, decision makers at IWCF must pay attention to the training obstacles this study uncovered. For example, the wording of the test questions was one of the main issues all candidates mentioned, even for those who are British and Scottish. Misunderstanding the meaning behind the test questions leads the candidates to stress and panic and that results in missing some marks on the test. Not understanding the questions frustrates them, especially because they are native speakers of English and not knowing the exact meaning of the question has nothing to do with their educational level, since even the engineers complained about how IWCF words the questions. Also, allowing the candidates to review their exam papers to know their mistakes will increase the trust level among drilling personnel in the credibility of IWCF examination system. Moreover, when the candidates know their mistakes, it will allow them to look for the right answers and start to correct their understanding of some concepts. That will therefore increase their confidence level in their knowledge and experience. As practical learners, knowing their mistakes will help them to adjust their cognitive background and rebuild their knowledge based on what they learn from their mistakes. Otherwise, it might take an individual up to eight years to know the right answer for the question that they failed if they have to renew their certificate every two years and each question has four possible responses. Also, to create a safety leader, IWCF training should allow candidates to practice their role as leaders by creating some simulator scenarios where the leader, regardless of their leadership style, can perform company safety standards, encourage their crews to follow these standards, monitor

unsafe behaviour, and motivate their crews to better themselves. That will require the drilling simulator designers to integrate all main drilling operations and well control problems associated with these operations. This integration must include the theory that explains each method and gives some valuable learning tools, namely hands-on practice, exercises and calculations, and strategies that can be applied to deal with risks related to these operations in designing a structured learning environment. That would help IWCF candidates recognise how to relate what they learn throughout the training to the work context, because according to adult learning principles they are practical learners.

5.5 Onshore and Offshore Personnel Implications

This suggestion addresses onshore and offshore personnel. All personnel, whether they are seasoned, less experienced, or new must accept all the kinds of developments and changes the industry is going through. Also, they have to be open-minded and accept the fact that what was working properly ten years ago might not be the appropriate method to use with the new technology and equipment. As a leader, they have to maintain a safety culture when they perform their job. As the results show that "leading by example" is the most powerful approach to teach positive and safe attitude and behaviour, leaders, whether they are transformational or transactional leaders, must demonstrate professional leadership attitudes such as

- applying and respecting the company's safety policy,
- communicating effectively with their crews about safety concerns,
- monitoring safety standards,
- delegating some responsibilities to their crews,
- preventing unsafe behaviour,

- motivating their crew to be safer,
- trusting their crews, and
- being a good example by knowing and applying the safety standards.

All personnel who are entitled to hold well control certification should realize that renewing the certificate every two years is a great opportunity to learn new knowledge, refresh their memory, and meet with new people from different work backgrounds. Moreover, they have to look at the training, whether it was for the first time or for renewal, as a learning experience and not as a mandatory training experience, because their attitude toward the training will be transferred to their team. Usually, personnel talk about their training experience to their colleagues and followers, so if these leaders have a positive attitude toward the training their team will probably have the same attitude when they attend the training. Undoubtedly, having this certificate is official proof of their competence level, but it is also important to each leader to be able to guide and monitor their crews and be able to explain the procedures and give directions.

Drilling personnel also have to develop self-awareness and be self-learners. To help them overcome the training obstacles. For example, the IWCF website provides many helpful learning materials and exercises that are available for everyone. So, they can train themselves and be prepared before they attend the training instead of complaining about how difficult the course is. Furthermore, the industry needs more personnel who have a sense of self-responsibility and do not stop at taking only the mandatory training, but go beyond it to frequently develop their skills and knowledge regardless of their level of education or their background.

5.6 Well Control Training Providers Implications

Accredited well control training providers should update their training materials according to the changes in the industry. However, that does not mean we should apply these changes on paper only, but also to their actual instruction. That also requires competent, objective instructors who accept the changes and who are not biased and "stuck" with the old methods. Most significantly, they must look at the training that they deliver as an imperative learning tool to be well-informed with respect to the up-to-date information in the drilling industry in general, and well control in particular. Although they might not do this because it is a business and this is their career, at the end of the day they are overall responsible for delivering a positive attitude throughout their instructing of well control training programs. As a result of this attitude, drilling personnel might change their negative opinions of these kinds of accredited examination and certification programs. IWCF instructor must know their audience who mostly have some drilling experience and internally motivated to achieve this training. So they should build learning activities and scenarios that motivate learners to learn and strengthen their knowledge and skills. IWCF providers must create useful relevant learning materials that can emphasize on practical knowledge. Providing practical experience would allow adult learners to construct knowledge in a way that is meaningful to them. Likewise, the training providers must design some scenarios that facilitate group discussions so learners can exchange knowledge and enrich each other experience. Also, they have to challenge learners' ability by providing different problem solving exercises and ask learners to look for and find solutions. IWCF providers must take into consideration that individual individuals learn differently based on their experience and

attitude toward training, therefore they have to provide varied learning sceneries to meet with different types of learners.

5.7 Recommendations for Future Studies

The sample for the current study was initially chosen out of onshore and offshore drilling personnel who were required to achieve the IWCF Rotary Drilling Well Control certificate at driller and supervisor levels. All participants attended the training at International Oilfield Training Solutions (IOTS) from April to December of 2013. The goal was to create a snapshot of the perceptions made by onshore and offshore personnel about IWCF certification as an applied training program and its ability to develop safety leadership skills. The results show that IWCF training can, according to the views of the participants, improve safety leadership skills that related to well control situations. 70% of the participants agreed that the safety skills that have learned from IWCF training can be transferred to other drilling operations, not just well control operations.

Based on the importance of the scientific research in advancing the value of building safety culture through leadership, I suggest a number of future studies, including:

- Conducting a similar study on the importance of IWCF training on developing safety leadership skills by using a greater sample size.
- Conducting a similar study by using personnel from different ethnicities who have to take IWCF training namely Europeans, Australians, and Middle Eastern drilling personnel.
- Carrying out a similar study to measure the effectiveness of IWCF Rotary Drilling Well Control training on developing other nontechnical skills such as communication,

management, and accountability by using a combination of qualitative and quantitative research methods.

- Conducting a study to compare IWCF Rotary Drilling Well Control training to IADC WellCAP Well Control training and their impact on developing safety leadership skills.
- Conducting a study to explain how safety leadership skills influence safety performance outcomes in well control situations.

5.8 Conclusion

This is the first academic study that attempts to gather onshore and offshore personnel opinions regarding IWCF Rotary Drilling Well Control Training Program and its ability to develop safety leadership skills. 40 semi-structured interviews were conducted to collect data to answer the overarching research question, "What is the relationship between technical training and developing safety leadership skills among onshore and offshore drilling crews?" The study has demonstrated that there is a relationship between IWCF training and developing safety leadership skills. This research has indicated that IWCF training as a technical training has the potential to develop drilling personnel's safety leadership skills that relate to well control operations. However, these results cannot be generalized to include other onshore and offshore personnel perspectives, and not even other well control training programs. Nevertheless, this belief can be potentially changed if the drilling well control training providers are aware of the industry required skills and the trainees' needs to build their training programs to achieve these skills. The majority of these training programs targets adult learners, therefore if the training itself is administrated with well-designed curricula and materials that consider adult learning

principles and is delivered by experienced instructors, it could then meet the industry needs and requirements. All the above three components: curricula, course materials, and instructors have a great impact on developing a positive recognition of technical training programs and their ability to improve nontechnical skills.

Likewise, if all stakeholders, including the international oil and gas industry, IWCF organization, accredited training providers, and onshore and offshore personnel implement their responsibilities as they should, they will most definitely improve the safety culture. More academic research is required to investigate in depth how technical training can help the oil and gas industry to strengthen a safety culture within its personnel. Improving the competence level of drilling personnel plays an effective role in raising risk awareness and to avoid or reduce the human errors that could cause deadly disasters that might impact human lives, the environment, and other natural resources. The development of such skills could be achieved by implementing a number of major improvements such as well control techniques, well control training, assessment and testing devices, and blowout preventers (BOPs) design to reduce the likelihood of deadly blowout events from occurring again.

Even though the IWCF organization has invested an extensive amount of work into developing the well control training detailed in this dissertation, there is undoubtedly more work to be done. This work was based on the OGP Report No. 476 (2012) recommendations which detail the conceptual design for drilling well control training. For example, additional work will be required to develop and implement standardized well control training programs and drilling simulator software.

Furthermore, the focus on safety leadership as an important factor in the oil and gas industry is increasing because it is recognized that senior leaders play an effective role in establishing the kind of safety environment which encourages workers to behave in a more conscientious way. However, more research needs to be done in order to clarify the exact nature of the influence of rig supervisors on safety performance and how better leadership can strengthen safety culture on multicultural drilling rigs.

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APPENDIX A: SEMI-STRUCTURED INTERVIEW QUESTIONS GUIDE

Basic Descriptive Information

- age,
- their job title and responsibilities,
- level of education,
- type of rig operations: whether onshore or offshore operation,
- how many years of experience that they have in the drilling industry,
- whether if they have an international experience or just a local one,
- whether if they have only onshore or offshore experience or both,
- how many times that they have taken IWCF training.

Interview Questions Guide

1. What is your opinion on the IOTS performance, manual, instructor, and teaching methods?
2. Why do need IWCF certificate?
3. What is your opinion of the IWCF training with respect to the adequacy of the assessments?
4. How do you define safety leadership?
5. What are the most important safety leadership skills that you need to improve your performance?
6. How do you lead your crew?
7. As a driller or a supervisor, which module of IWCF training, equipment or principle and procedures?
8. How would you describe the value and importance of IWCF training to your career?

9. In your opinion what motivate you most to pass IWCF examination?
10. Name the main training obstacles that you faced when you attend your training?
11. Name the obstacles that prevent you from mastering your job responsibilities?
12. What is IWCF training's role in terms of helping you identify these obstacles?
13. Describe your work relationship with locals?
14. Describe your work relationship with engineers?
15. Describe your local drilling experience?
16. Describe your international experience?
17. What are your suggestions for IOTS to enhance the quality of IWCF training level?
18. If you work on an international rig site, identify the effect of language barrier on working safely?
19. How well does IWCF training as a technical training improve your safety leadership skills?

APPENDIX B: INVITATION LETTER

University of Calgary
Werklund School of Education
Graduate Division of Educational Research

Dear IWCF Candidate,

This letter is an invitation to participate in a research study. I am a PhD Candidate in the Department of Educational Research at the University of Calgary conducting research on the Relationship between Technical Training such as IWCF Rotary Drilling Well Control training and developing safety leadership skills among onshore and offshore drilling crew members. I am also an employee of International Oilfield Training Solutions (IOTS). However, I am not connected to your training program or to your assessment. Participation in this research is voluntary and in no way a requirement of your employment; your non-participation or withdrawal will have no negative effect on your continuing relationship with your employer or with International Oilfield Training Solutions (IOTS).

Study Overview

As you may know, IWCF certification is universally accepted by the most of Drilling Operators and Contractors. This certification program aims to emphasize drilling knowledge, principles, and procedures in order to increase the efficiency of crew members. It also teaches safe work procedures to avoid or reduce human errors that could cause deadly disasters.

The first purposes of this study is to identify how training schools implement International Well Control Forum (IWCF) Rotary Drilling Well Control training program to respond to the global need to improve safety leadership skills of crew members in the oil and gas industry in general, and the well drilling industry in particular. This identification is based on IWCF training objectives (IWCF Accredited Centre Manual, 2008: p. 69-71): (a) "to raise crew awareness and enhance the knowledge of human factors that can cause incidents related to safety or production; (b) to develop applied and non-technical skills and attitudes; (c) to integrate IWCF knowledge, skills, and attitudes into current work practices". The second purpose of this study is to identify the main difficulties the trainees face during the training that might challenge their abilities to pass this challenging training. The identification of these difficulties provided a rich description of how IWCF training can develop safety leadership skills. This development was built on deep understanding of the technical aspects of crew members' roles and by accurately responding to the simulation test where the candidate confronts critical drilling situations that require a quick, cautious response based on good safety leadership and communication skills with other crew members to ensure safety and prevent accidents.

Your Involvement

Because you are an onshore\offshore crew drilling member, your opinion is of great importance to this study. Thus, I would appreciate the opportunity to speak with you about this. Participation in this study is voluntary and anonymous. It would involve a 60 minutes of your time to complete an interview conducted in the International Oilfield Training Solutions (IOTS) office on the fifth day of your training course. I will be scheduling in-person interviews between 1:00 p.m. to 5:00 p.m. and you can choose the time that suits you well. To ensure the accuracy of your input, I would ask your permission to audio record the interview. There are no known or anticipated risks to your participation in this study. The questions are quite general. You may decline answering any questions you feel you do not wish to answer. All information you provide will be considered confidential and grouped with responses from other participants. Furthermore, your name and the name of your employer will not be identified in any thesis report or publication resulting from this study. The data collected through this study will be kept for future research in my supervisor's office at the University of Calgary. If you would be interested in greater detail, an electronic copy of the entire research proposal can be made available to you.

If you are interested in participating in this study, please sign the informed consent attached to this letter and return it to me. If after receiving this letter, you have any questions about this study, or would like additional information to assist you in reaching a decision about participation, please feel free to contact the researcher at aaabulha@ucalgary.ca There are no ramifications whatsoever for those who choose not to participate.

I would like to assure you that the University of Calgary Conjoint Faculties Research Ethics Board has approved this research study. However, the final decision about participation is yours.

Thank you for your assistance with this research study.

Yours sincerely,

Aber Abulhassn

PhD Candidate

APPENDIX C: INFORMED CONSENT

University of Calgary
Werklund School of Education
Graduate Division of Educational Research

Dear IWCF Candidate

Please take the time and read this carefully and to understand any accompanying information. The main use of collected data will be to inform the researcher's PhD degree project. The University of Calgary Conjoint Faculties Research Ethics Board (CFREB) has approved this research study. Participation in this research is voluntary and in no way a requirement of your employment; your non-participation or withdrawal will have no negative effect on your continuing relationship with your employer or with International Oilfield Training Solutions (IOTS).

Basic Information of the Study

Title of the Study

The relationship Between Technical Training and Developing Safety Leadership Skills Among Onshore and Offshore Drilling Crews.

Purpose of the Study

There are two purposes of this study: (1) to identify how training schools implement International Well Control Forum (IWCF) Rotary Drilling Well Control training program to respond to the global need to improve safety leadership skills of crew members in the oil and gas industry in general, and the well drilling industry in particular. This identification is based on IWCF training objectives (IWCF Accredited Centre Manual, 2008: p. 69-71): (a) "to raise crew awareness and enhance the knowledge of human factors that can cause incidents related to safety or production; (b) to develop applied and non-technical skills and attitudes; (c) to integrate IWCF knowledge, skills, and attitudes into current work practices". The second purpose of this study is to identify the main difficulties the trainees face during the training that might challenge their abilities to pass this challenging training. The identification of these difficulties provided a rich description of how IWCF training can develop safety leadership skills. This development was built on deep understanding of the technical aspects of crew members' roles and by accurately responding to the simulation test where the candidate confronts critical drilling situations that

require a quick, cautious response based on good safety leadership and communication skills with other crew members to ensure safety and prevent accidents.

What Will you Be Asked to Do in the Study?

You will be asked to volunteer to answer interview questions. If you agree to participate, you will be asked to provide some personal information such as: your age, type of installation rig (onshore or offshore), job title, and years of experience.

You will be asked to participate in an interview lasting no longer than 60 minutes. You will not have to answer any question you do not wish to answer. The interview will be conducted at International Oilfield Training Solutions (IOTS) office, on the fifth day of your training after completing the written exams and after I receive a copy of this singed consent from you.

With your permission I would like to audiotape the interview and I will personally transcribe the interviews and remove any identifying comments during transcription. Your identity will be kept confidential to the extent provided by law and your identity will not be revealed in the final manuscript.

Are There Risks or Benefits if I Participate?

There are no anticipated risks to you as a participant in the interview. You are free to withdraw your consent to participate and may discontinue your participation in the interview at any time without consequence.

What Happened to the Information I Provide?

Participation is completely voluntary, anonymous and confidential. You are free to discontinue participation at any time during the study. No one except the researcher and the research supervisor will be allowed to see or hear any of the answers to the interview tape. Only group information will be summarized for any presentation or publication of results. The interview records are kept in a locked cabinet only accessible by the researcher and the research supervisor. The data will be stored on a computer disk for an indefinite period of time to be used for future research.

Due to the nature of data collection activities, absolute confidentiality cannot be guaranteed and your research participation may be recognized by other participants and by IOTS staff members.

Signature

Your signature on this form indicates that you (a) understand to your satisfaction the information provided to you about your participation in this research project, and (b) agree to participate as a research subject.

In no way does this waive your legal rights nor release the researcher and involved institution from their legal and professional responsibilities. You are free to withdraw from this research study at any time; however, data collected to the point of withdrawal will be used. You should feel free to ask for clarification or new information throughout your participation.

Please sign and return this copy of the consent to the researcher. By signing this consent, you give me the permission to report your response anonymously in the final manuscript to be analysed and submitted as the research results to conduct the effectiveness of IWCF Rotary Drilling Well Control training in developing safety leadership skills.

Yours truly,

Aber Abulhassn

PhD Candidate

Email: aaabulha@ucalgary.ca

Consent Form

I have read the information presented in this letter about a study being conducted by Aber Abulhassn of the Graduate Division of Educational Research at the University of Calgary, under the supervision of Professor Ian Winchester. I have had an opportunity to ask any questions related to this study, to receive satisfaction answers to my questions, and any additional details I wanted.

I am aware that I have the option of allowing my interview to be audio recorded to ensure an accurate recording of my responses.

I am also aware the excerpts from the survey and/or interview may be included in the thesis and/or publications to come from the research, with the understanding that quotations will be anonymous.

I was informed that I may withdraw my consent at any time without penalty by advising the researcher. I am also aware that data collected to the point of withdrawal will be used.

I am aware that due to the nature of data collection activities, absolute confidentiality cannot be guaranteed and my research participation may be recognized by other participants and by IOTS staff members

I am also aware that data will be stored for an indefinite period of time to be used for future research.

I was informed that this project has been reviewed by, and received the University of Calgary Conjoint Faculties Research Ethics Board (CFREB) approval. I was also informed that if I have any comments or concerns resulting from my participation in this study, I may contact the CFREB.

With full knowledge of all foregoing, I agree, of my own free will, to participate in this study.

____ Yes ____ No

I agree to have the in-person interview audio-recorded.

____ Yes ____ No

I agree to the use of anonymous quotations in any thesis or publication that comes of this research.

____ Yes ____ No

Participant's Name: (please print) _____

Participant's Signature: _____ Date: _____

Researcher's Name: (please print): _____

Researcher's Signature: _____ Date: _____

Questions\Concerns

If you have further questions or want clarification regarding this research and \or your participation, please contact:

Aber Abulhassn

Department of Educational Research\Werklund School of Education

Email: aaabulha@ucalgary.ca

A copy of this consent has been given to you to keep for your records and reference. The researcher has kept a copy of the consent form.