Oil Well Control Training and Safety Leadership Skills of Drilling Personnel

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ABSTRACT: This research investigates the relationship between the most important rotary drilling oil well control training program and developing safety leadership skills among onshore and offshore drilling crews. The findings of this study indicate that this technical training program appears to improve safety leadership skills in well control situations. The results also suggest that these safety leadership skills could be transferred to other drilling and well operations, although there is some disagreement on the degree of possible transfer.

Keywords: safety leadership, leading by example, drilling operations, IWCF certification.

RESUMÉ: Cette analyse essaie d'établir le lien entre le programme de formation d'encadrement de la plus importante foreuse rotative de puits de pétrole et la constitution des qualités d'encadrement en matière de sécurité au sein des équipes de sociétés de forage à terre et des équipes de plateformes pétrolières. Les résultats de cette analyse indiquent que ce programme de formation technique paraît améliorer les qualités d'encadrement en matière de sécurité dans la supervision des puits et aussi, que ces qualités d'encadrement pourraient très bien convenir à d'autres forages ou exploitations de puits, bien que cela suscite des divergences d'opinion quant à la mesure dans laquelle elles pourraient être transférées.

Mots-clés : encadrement en matière de sécurité, montrer l'exemple, exploitations de forage de puits, certificat IWCF.

Introduction

At the present time, the oil and gas industry faces numerous challenges to implementing and maintaining a safety culture. Specifically, two main factors contribute to these challenges, especially on international drilling sites. First, the recent arrivals to the workforce have come to the industry with higher levels of formal education than their leaders. Second, the integration of

foreign workers into this industry has resulted in an increasingly diverse work environment (Gordon, 1998). Both kinds of diversification have created increased challenges for implementing standardized safety culture or training activities because of communication difficulties between crew members of varying backgrounds.

These two factors have created gaps between the less educated leaders and their crew members regardless of whether 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 as a formal source for improving both applied skills 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. In addition, most of the local and international drilling companies have recently been attempting to learn and to act on lessons from the Piper Alpha accident in the North Sea and the Deepwater Horizon accident in the Gulf of Mexico and other damaged oil rig disasters. They have an increased awareness regarding the importance of safety training 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).

Moreover, 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. This paper focuses on the selected onshore and offshore drilling personnel' views on how their safety leadership skills improved by using the International Well Control Forum (IWCF) Rotary Drilling Well Control Training Program.

The Historical Background of International Well Control Forum (IWCF)

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 training is safety-related in order to keeping some continuity on how to conduct well control operations.

Definition of Terms

IWCF Rotary Drilling Well Control Certification Program: IWCF Rotary Drilling Well Control Program 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).

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)

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

Offshore Drilling Operations: Offshore drilling operations are defined as intensive oil or natural gas exploration drilling activities that happen in deep water.

Research Methodology

A qualitative case study approach was well suited for the nature of this 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. This research is the first study that has tackled IWCF Rotary Drilling Well Control Training Program, and it has produced 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. Additionally, a rich description is included as a base for future research. In this study, participants described their experiences during IWCF training and discussed how the knowledge they obtained from the training could complement and increase their level of professional skills.

Merriam (1988) claimed that case studies provide a 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 of the construction of the well control knowledge that they had gained from IWCF training and how they would implement it 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, by using qualitative case study I was able to (a) generate a well-grounded and sufficient comprehension of the role of IWCF certification in the participants' careers and how it could be used to improve their safety leadership skills, (b) collect and analyze valuable and previously unresearched data, and (c) to determine whether IWCF training has an impact on developing safety leadership skills.

Data collection method

A semi-structured interview technique was chosen for data collection, as it was both sufficient and necessary technique to better understand how the participants interpreted the importance of IWCF certification in the industry and its impact on their professional skills. The 40 semi-structured interviews, 45 minutes in length, gave me the opportunity to listen to relevant 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.

Research Sample

Purposive sampling was used for this research because it involved designating a group of people who were selected based on their experience and knowledge necessary to this research. Using this sampling approach was imperative because it allowed me to focus on the characteristics of IWCF candidates that are of

interest, and to determine the relationship between IWCF training and safety leadership skills (Tongoco, 2007). Since this research required certain types of participants, I created a set of criteria requiring candidates to be:

- either a surface driller, surface supervisor, combined surface and subsea driller, combined surface and subsea supervisor, and I chose ten participants from each endorsement,
- internationally employed or working in Canada for an international employer,
- new to IWCF or renewing their IWCF certificate,
- Canadian citizens or residents, and
- Native English speakers.

Based on the above criteria, my sample size was 40 participants who attended IWCF training at International Oilfield Training Solutions (IOTS) in Calgary and St. John's centres from April to December 2013.

Research Results and Discussion

1. Safety leadership skills

How the participants defined safety leadership skills was based on their own work experience and their demonstration of these skills when leading their crews 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 both need to demonstrate safety leadership skills, because both are in leadership positions. Since both drillers and supervisors are involved in high-risk operations, their leadership style must emphasize safety, because, according to Oil & Gas Producers Report No. 452 (2013), safety culture starts with leadership.

The main mission, as a surface supervisor reported, for all oil companies and drilling contractors regarding safety is that "Everyday, everyone who works on the drilling rig must go home safe, and with all their fingers and toes" From this perspective, all participants affirmed that they have to explain to their crews the consequences of unsafe behaviours and all the risks associated with them. Most drilling rigs use what is called an *Observation Card*, sometimes referred to as a "Stop Card," which are both used to record or stop the unsafe behaviours or attitudes that occur on a day-to-day basis. At the start of each shift, the crew leaders review the main safety procedures and give their 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 reiterate what must be done in case of an emergency.

Likewise, if the *observation cards* identify a high risk or an unsafe attitude, the crew leader must discuss these issues 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 card* aims to empower all crew members to identify and stop unsafe behaviour and correct it before they proceed with their jobs. Even though drilling activities are associated with high risks, the rig is a much safer work environment when all crew members have the skills and knowledge to do their job safely (Abulhassn, 2015). This was also demonstrated in Henson's study (2013), where he claimed that offshore drilling rigs could be safer if every crew member had the safety awareness and skills to manage risks. He also found better leadership was an important indicator of safe performance.

All participants, without exception, agreed that "leading by example" is the most effective leadership style to maintain safety on the drilling rig. Leading by example is a very powerful tool. When the leaders are involved in the drilling procedures and tasks, 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 clear way so the crews can understand how to avoid or reduce risks. Usually, in any drilling crew, members follow the example set by their supervisors of how they perform in certain situations. If the leaders cut corners and take short cuts, the crews will do the same, under the assumption that it is normal and that it produces the same results. Crews detect what their leaders do, whether it is good or bad. Therefore, many participants interviewed emphasize that drilling leaders must fully understand and follow the company's safety policies and procedures. They also have to be aware of occupational, health, and safety legislation for the country where the drilling practices are taking place.

Furthermore, all participants indicated that leading by example also requires that leaders have the ability to explain the reasons behind any instructions they give to their crews and provide concrete and relevant examples. Simply directing their crews without explanation will not make safe workers, rather providing reasons and examples 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, many participants, especially combined surface and subsea drillers and supervisors, noted that blaming crew members will not teach them the proper safety procedures, and as one combined surface and subsea supervisor mentioned, crews will be afraid to talk to their leaders or ask questions if they perceive they may be blamed or reprimanded. This may cause crews to proceed with their tasks mistakenly, assuming that they know how to execute them, leading to more disasters as they may not have the knowledge or experience to deal with some critical situations.

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

The analysis of the interview data indicated that safety leadership skills mean that leaders are proficient at their job and reliable, know each crew member's job responsibilities, and are able to identify each person's abilities and limitations. Having these qualifications allows leaders to be comfortable managing their crews and know that they are competent in dealing with critical well control situations when they occur.

Additionally, the analyzed data showed that having over eight years of international experience working for large organizations such as Shell, BP, Chevron, Seadrill, Ocean Rig is an asset for the majority of the participants. Emerging from the data were two main advantages of working for international employers. 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 has helped them develop many personal traits that have positively impacted their safety leadership skills; they have become more concerned, rational, and respectful for their crew regardless of their ethnicity, and developed patience, especially when there are language barriers.

2. Leadership styles

One of the significant findings shaping the definition of safety leadership skills is the leadership style the participants use to manage their crew. This style can be identified through the communications between the driller and supervisor during the practical part of IWCF training program. Tables 1 and 2 can help the reader understand the candidates' response to what type of leadership -transformational or transactional- they prefer to use on

a drilling rig. Their responses to this question can be categorized into three groups:

Table 1: Years of Local and International Experience for Surface Participants

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

Table 2: Years of Local and International Experience for Combined Surface & Subsea Participants

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

- *Group One*: Participants who were working in Canada and had never worked overseas, as well as the ones with just one year of international experience. This group believes that a transactional style of leadership is the more preferable style to use on a drilling rig. According to them, it is the only style that they know and use due to the nature of the drilling activities in Canada, whether in Alberta or Newfoundland. These activities require obedient crews who carefully follow

the instructions they receive from their supervisors. According to some surface drillers, the operating philosophy on drilling rigs in Canada is based on a "dictatorship," where the power is granted to certain individuals who hold higher positions in the rig hierarchy, such as field superintendents, drilling supervisors, or rig managers. Group one participants believe that this style makes them work better and stay focused. For example, one of the surface drillers who had 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 example aligns with Houser's study (2010) described working on drilling rigs in Alberta. This candidate mentioned 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. He felt screaming was more effective than receiving a written warning.

- *Group Two:* Participants who had two to seven years of international experience. This group is obligated to use a combination of both leadership styles, because of signed agreements between the oil company and drilling contractors. Another reason this group uses a combination of leadership styles is country legislation obliging the oil company to provide jobs for locals. The participants from this group indicated that using a solely transactional style of leadership does not work well with 40% - 50% of locals working on that rig, as it violates local regulations on international settings.
- *Group Three:* Participants who had 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 crew engagement, by 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, as well as the country's legislation.

Nevertheless, the most unexpected finding was that the older leaders who have been working internationally for more than eight

years are typically transformational or situational leaders. The older generation typically prefers a transactional leadership style to ensure their crews are following given instructions. However, because they have substantial international experience that has taught them how to deal with different personalities, cultures, and drilling backgrounds, they usually motivate their crews to do better at their positions. My interpretation of this unexpected finding is that these senior leaders have worked in many different local and international drilling industries, they are typically open-minded and want to leave a legacy behind in each place they work. Therefore, more senior supervisors often delegate crucial responsibilities to their younger crew to expose them to different perspectives of drilling operations. They are also more likely to discuss procedures with their crews to allow them express their opinions and concerns about which procedures to undertake in different situations.

3. Qualities of good safety leaders

All participants defined safety leadership skills as the ability to identify hazards in new situations. In addition, all participants indicated that certain qualifications are necessary to be a safety leader. Participants provided many examples of what leaders must do: leaders must

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

In the qualitative data I collected and analyzed, there were many instances where participants described the skills that are essential for each drilling leader to be a safety leader. Their descriptions reflect the main characteristics of both transformational and transactional styles.

Moreover, in many aspects their descriptions overlapped with 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*: effective 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 decisions with their crews and they accept 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 concern for providing a safe work environment.
- *Communication*: effective 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 tasks.
- *Being proactive*: effective leaders are able to identify risks before accidents occur to ensure nobody is injured. This is particularly true for those leaders who started their rig career in an entry-level position such as a roughneck, and have progressed to their current position, because 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 all crew members know their role. They also encourage their crews to report any safety issues, and they track accidents that were avoided.
- *Accountability:* effective 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*: effective 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 and maintain a safety culture that reflects the company vision.

The participants further identified an effective leader as one who can demonstrate these skills in the workplace, be a role model for their subordinates, know their crews, and adjust their leadership style according to each situation.

4. The relationship between technical training and safety leadership skills

Six of the ten participants interviewed at surface driller level believe that the IWCF training program has the ability to improve safety leadership skills that relate to well control operations. They reported learning from this course how to react safely to unexpected well control situations in order to prevent injuries. The decisions that they make in the field reflect the knowledge they acquire from the IWCF course and their understanding of well control operations. Seasoned surface drillers reported that IWCF training could help leaders to better know their crews and the strengths and weaknesses of each crew member. They can also pass along the knowledge that they obtained from this training to crew members, such as roughnecks and assistant drillers to build up their level of competence until they are ready to take such training. Supervisors interviewed have noticed that these junior crew members have the potential and ability to integrate the advice and directions that their supervisors give them and they are able to demonstrate safe behaviour that ensures their supervisors trust their performance. Furthermore, the performance of these junior crew members proves that these personnel have very important attributes, such as great determination and goals to improve their skills and move forward in their career.

In contrast, four of the ten participants interviewed 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 lives of the personnel.

Supervisors from both endorsements indicated that working on drilling rigs means dealing with many "green" or inexperienced crew members. This term is used in the oil and gas industry to describe personnel who do not have the adequate knowledge or experience to deal with critical operations. This term also includes the new engineers who have just graduated from school and lack practical experience. The supervisors interviewed reported that some of those new personnel may hold high positions because of luck or connections. Having some "green" crew members working on the rig site means incidents will continue to occur, 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. They claimed that if the oil company hires safety officers on the rig floor to monitor risks and hazards, all what the safety officers can do is to advise crews on how to minimize these risks and hazards, despite the safety officers lack of drilling background.

All participants reported that IWCF training, or any well control training, aims at educating drilling crews about well control and the risks associated with drilling operations. However, only 70% of the participants believed that understanding the risks of well control can be applied to all other well operations and activities.

5. Prior safety experiences

One of the most significant findings highlights the importance of developing safety leadership skills when crews deal with heavy equipment. About 40% of the participants grew up on farms; therefore, they had experience around heavy equipment and

machinery and were aware of the potential dangers. They all indicated that their fathers taught them how to work around heavy equipment when they were very young kids. Their fathers were their role models, and as boys they followed them and absorbed their ways of dealing with machinery. Hence, the farming experience helped lay the foundations of safety leadership skills, while they have refined throughout the years. When these respondents began working on drilling rigs, it was easy for them to recall the lessons from their early farming experiences. So, they built their safety leadership skills from both life experience and work experience, which have both contributed to making them better leaders.

Similarly, 30% of the participants were previously fishermen in the province of Newfoundland. The conditions were very harsh and patience was required for this job. Fishery experiences helped them to internalize a strong sense of danger and learn to watch out for themselves and everyone on the boat. One 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 in dangerous conditions. As he was the oldest brother he was 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 transferred their skills and became even more safety-oriented workers. Similarly, these participants have transferred this safety awareness to their drilling rigs.

One of the surface supervisor participants gave another relevant example of the importance of being aware of responsibilities toward safety. He stated that his experience with the Canadian Navy had a great impact on shaping his safety leadership skills. There he learned how to act quickly and correctly under 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, but that there was no need for safety officers because each individual fully understood that safety must shape all their actions and decisions. Accordingly he reported, a culture of safety was embedded throughout the Canadian Navy.

All the participants interviewed who have farming, fishery, and Canadian Navy background claimed that some companies shape their safety culture by filling out all the required paperwork, checking the equipment, completing risk analyses, and conducting safety meetings only to meet the insurance requirements. They divorce themselves from personal responsibilities for safety. They have not been able to internalize the safety culture as a quality that must trickle down from the company president or CEO to the leasehands.

Conclusion

This study has demonstrated that there is a relationship between IWCF training and developing safety leadership skills. The goal was to create a snapshot of the perceptions made by the selected 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, based on the qualitative case study results stemming from semistructured interviews, improve safety leadership skills that relate to well control situations. 70% of the participants agreed that the safety skills they have learned from IWCF training can be further transferred to other drilling operations, beyond well control operations.

Based on the research findings standardized 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. This standardization has the potential to help the industry to avoid and reduce deadly accidents, both those officially filed and those not.

More academic research is required to investigate in depth how technical training can help the international oil and gas industry to unite universal drilling operations and develop a strong safety culture within its personnel. Therefore, 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 such as Deepwater Horizon accident that might impact human lives, the environment, and other natural resources. 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 oil rig sites.

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