

AN EVALUATION OF ENGINEER'S RESPONSE TO SAFETY SYSTEM IN THI-QAR OIL FELID

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Received:	28 th September 2024	<p>The study investigates the safety systems in Thi-Qar oil field located in southern part of Iraq and looks closely for engineers interact with safety systems by determine if the safety protocols act as it should. oil fields are considered as high-risk environments as result, the study seeks to understand engineers' perceptions and implementations of safety systems in oil fields. The objectives of the study are studying the historical content, assessing the current practices of safety systems and highlighting safety practices importance. The literature studied the development of safety standards in historical review and, present safety protocols and case studies for safety management. the results finds that important progress have been taken to set up safety protocols due to the efforts of organizations such as the American Petroleum Institute and OSHA .there are still some compliance, training, and infrastructure issues that present challenges to those safety protocols. Lastly, this research finds that fostering a robust safety culture alongside real-world engineering problems in advanced technologies requires much more than just a timid safety approach. To ensure safe operations in the Thi-Qar oil field, a real-world approach must incorporate untold feedback from both successful and unsuccessful advanced technological operations. The research recommends strategies such as bolstering enhancing training programs, employing interdisciplinary collaboration, and improving the adaptability of safety management systems.</p>
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INTRODUCTION:

The oil and gas sector works in a risky environment, where ensuring safety is of utmost importance. The importance of safety systems in oil and gas sector can't be overstated when drilling deep into the Earth and conducting other operations, personnel can face huge hazard. Despite of using advanced technology and an abundance of regulations intended to promote safety and environmental protection. Many safety systems are in place, and still disaster seems to strike with alarming regularity. This study investigates systems in place to promote safety in the Thi-Qar oil field in Iraq, a region notable for its geological and infrastructural challenges (Abdulridha & Supeni, 2019).

The research question guiding this exploration is: what is the engineer's response to safety systems in the Thi-Qar oil field? To address the research question of what is the engineer's response to safety systems in the Thi-Qar oil field? Investigation had made of how engineers perceive, implement, and comply with safety protocols. The background of this study and comprehensive literature review, examines the evolution of safety standards, the importance of compliance, and real-world incidents that provide critical insights into safety management practices.

This investigation is necessary to obtain a thorough understanding of the existing safety systems in the Thi-Qar oil field. It is not enough to know just the successes; we must also recognize the limitations that the existing systems have in order to be truly safe. Having this knowledge can make better situation for oil and gas sector in Thi-Qar oil field, especially with the knowledge that oil fields are risky places for workers.

1- Historical Development and Standards of Safety Systems

Safety systems evaluation in the oil and gas industry had transformation of workplace safety from basic system to advanced one where safety teams have verifiable guidelines for ensuring safe operation. The main milestones of this development include American Petroleum Institute (API) standards establishment and Occupational Safety and Health Administration (OSHA) Formation. These two safety enhancements and their importance cannot be overemphasized in the high-hazard oil and gas sector for the potential accidents and the consequences of accidents in oil and gas sector. The oil and gas industry owes much of its safety to API standards. Take API 653, for example. It is devoted specifically to the many ways tank damage. Matthews (2023) states that API RP 571 is a significant issue in the storage tank integrity, with guidelines not just for American Petroleum Institute (API) but for all kinds of damage mechanisms that can affect tanks and other pressure vessels. In 1970, the establishment of OSHA was a big step forward for worker safety in different industrial settings.

The Occupational Safety & Health Act of 1970 by Williams-Steiger was designed to close the large and dangerous gaps in worker protection that were all too evident at the time. Prior to the Occupational Safety and Health Act, there were no substantial federal regulations to protect workers from the well-known and the not well known diseases that are caused by dangerous working conditions. The act that we now commonly refer to as "OSHA" set up that very agency; it also set up the NIOSH which is National Institute for Occupational Safety and Health and the Review Commission, giving the worker a much more substantial "legal" reason to expect safe and healthful working conditions (Wang et al., 2023).

OSHA has been extremely important in reducing the number of worker's deaths, injuries, and illnesses. Its oversight has mattered because it has brought a much-needed order to how safety is handled in the workplace, compelling many industries, not least oil and gas, to adhere to strict safety standards. One of standards is OSHA's regulations that blowout preventer, which is an extremely important piece of equipment necessary for controlling and containing an out-of-control well in the event that something really goes wrong during drilling operations (Cohen, 2020).

These developments reflect workers understanding of how important safety systems are at work, and this is changing the safety landscape in many industries, especially oil and gas with its risky activities. Accordingly, Companies deal with high risks and have made safety systems part of their culture. Oil and gas firms have made big improvements by using API standards and following OSHA's rules. The way they handle risks has changed too. Instead of just reacting when things go wrong, they have a structured, proactive method for thinking about safety.

API and OSHA have had a reshaping influence on safety in the oil and gas industry. Their rules have done much more than set a baseline for safe work conditions; they have created an atmosphere in which safety culture is not just improved upon but is actually exploded into a flowering of constant, meaningful, and effective work toward further safe conditions. Safety is the number one priority in the oil and gas industry. Safety isn't about avoiding accidents. Real safety is about doing the right things in the right way every time and it is about not letting up on continuous improvement for ensuring the sustainability of risky sectors.

2- Importance of Safety Systems in High-Risk Environments

In high-risk environments such as oil and gas sector, Safety systems serve an important role in risk mitigating, ensuring the personnel protection in work, equipment protection, and the environment in workplace. Their investments in safety underscore the high costs that would be incurred if either personnel or equipment were to suffer some kind of incident in environments where safety is critical. Effective safety systems such as blowout preventers (BOPs) serve as a critical component in the safety system that prevents dangerous blowouts (Aderamo, et al., 2024). BOP is a crucial safety system used in high-risk offshore drilling operations. It's not just randomly distributed where needed; rather, it's indicative of a far deeper concern. In the offshore drilling world, blowout preventers aren't just prevalent; they've also become the subject of a vast amount of research dedicated to understanding their failure modes—the why and how of their not working when they're supposed to work, particularly in the very high-pressure environments of deep-sea drilling. This research has also been aimed at making them more reliable and, hence, more valuable as safety systems. One of the more comprehensive studies recently undertaken was that of (Aguiar et al., 2023), which looked into the major failure modes of BOP systems.

To address the staggering complexity of modern industrial systems and to improve the efficacy of safety systems like Blowout Preventers, (BOPs), (Shafiee et al., 2019) proposed an advanced methodology for risk management that exemplifies current trends in the development of risk analysis techniques. They integrated Failure Mode and Effects Analysis (FMEA) and Fault Tree Analysis (FTA) into a hybrid model. Both of FMEA and FTA are powerful methods for risk analysis. Each one of these methods has its strengths and weaknesses. The models like the one developed by

(Shafiee et al., 2019) are applied to BOP systems, they illuminate critical failure risks that might have been missed by traditional FTA or FMEA applications.

Another inventive tool is Building Information Modelling (BIM) that promises a valuable improving safety management in the oil and gas sector. BIM is used in the construction and architecture industries, manufacturing industries and high risk environment sectors to create precise virtual representations of structures. Virtual models can be used to identify risks and hazards in construction processes and the final product. Using BIM, potential destructive events that could impact the structure and the surrounding environment can be simulated. Yet BIM is not widely used in the industry, and the reasons for its underutilization are not entirely clear. Waqar, Othman, and González-Lezcano (2023) conducted a study in Malaysia, where the authors are based. They wanted to get a better understanding of the local context regarding BIM use in the oil and gas construction sector. Their 2023 article presents the study's findings

The studies underscore how complex safety management is in high-risk environments. From the industry and academic studies that we have reviewed, we derive that an effective safety system like a BOP must be continuously improved, rigorously maintained, and must function in a reliable manner to provide any hope of safeguarding the workers under its jurisdiction. We also derive from our studies that safety management in the industry can be substantially enhanced by advanced risk assessment techniques that are applied in a more nuanced manner and by adopting certain innovations, notably the use of building information modeling (BIM), in a more widespread and rigorous manner than is currently the case.

In summary, dangerous workplaces such as the oil and gas sector, safety systems are essential. They are made to stop huge disasters and make day-to-day activities operations more reliable. People in the industry often say that reliability and safety are two sides of the same coin. Both need the same strict maintenance routines, good management, and using helpful technologies, from reliable old ones to promising new ones.

3- Safety Challenges in Thi-Qar Oil Field

The oil field in Thi-Qar city in southern part of Iraq is presenting the challenges for safety underpinned by geological formation that is anything but straightforward, an aging infrastructure, and a politically volatile region. The Mishrif Formation, part of the oil field, is an intricate structure made up of many different layers. In a series of seismic surveys, the presence of potential hazards like reefs and faults were detected (Al-Rikaby & Al-Jawad, 2024). The authors point out that these geological features are the probable reason for flying off the drilling head noted in several well reports. Another way to look at that is to see these geological features as presenting a plot line certainly not friendly to drilling operations.

The main geological risks in the Thi-Qar Oil Field arise from the formation (Mishrif Formation) and its stratigraphic complexities. The different stratigraphic units have mismatched acoustic impedances, which accounts for the variety of subsurface reflections we see in seismic data. The region's seismic response is intricate to the point where we can only define it as complex (Al-Rikaby & Al-Jawad, 2024). Considering this complexity, the hazardous zones within the oil field can be best delineated using vertical seismic profiling in conjunction with three-dimensional depositional modelling which has been made possible through the recently attained high-resolution capability of the seismic survey. Still, even with the best techniques available, the varied nature of the rock layers makes some misinterpretation almost inevitable. When those misinterpretations cause seismic reflection images to be seen as visible subsurface structures, those structures can be plaintiffs in a lawsuit against the oil rig drillers.

The safety of the Thi-Qar Oil Field in southern Iraq depends on the integrity of its specific infrastructure, including its pipelines and drilling platforms. But as Coburn (2020) points out, aging structures in the oil and gas industry everywhere tend to be increasingly risky that likely to have leaks and operational failures which can lead to disastrous environmental and health consequences.

Ensuring safety in the Thi-Qar Oil Field is a complex challenge that requires not just one but several modern geological, infrastructural, and technological solutions—something akin to a "safety cocktail." The oil field is beset by a range of geological problems, which Olver's (2021) advanced studies make. Al-Rikaby and Al-Jawad (2024) has highlighted the problem and its impact on the oil field's infrastructure, which Coburn (2020) insists must be continually monitored, assessed, and held to the highest imaginable safety standards. Lastly, the infrastructure of the oil field working environment must be managed as if life itself depended on it and in an environment where almost any disaster would potentially imperil both the oil field's personnel and the people living in the surrounding communities.

4- The Safety Protocols Currently Implemented

Ensuring following safety protocols in the oil and gas industry is essential especially in the high-risk environment like Thi-Qar Oil Field for keeping employee's safe and ensuring that oil and gas operations run efficiently. The practicalities of how safety is ensured in the Thi-Qar field could be found through comparisons with international examples to help

illustrate the current state of adherence to, and the effectiveness of, those protocols. The comparisons with international examples will identify practices that are working well. By comparing the current situation with international examples, we can identify practices that are effective and yielding positive results. Ajmal et al. (2022) conducted a cross-sectional survey of 280 employees in the downstream oil and gas sector. Their study found that compliance with safety regulations enhances safety outcomes and minimizes the occurrence of occupational accidents and injuries.

The results of Ajmal et al. (2022) might not be directly suitable for the Thi-Qar Oil Field because of workplace cultural and geographical condition differences. Still, we can make a logical leap and assume that the safety compliance seen in the downstream sector could somewhat mirror safety conditions in the upstream sector of the Thi-Qar Oil Field. Likewise, Quaigrain et al. (2022) examined the oil and gas industry's occupational health and safety compliance in Ghana, drilling down on how the employees' knowledge and attitudes affect the industry's adherence to safety practices. Their research showed that while the employees had a generally high level of knowledge and a safe-positive attitude towards occupational health and safety, the oil and gas operations in Ghana did not always possess comprehensive safety practices. The same gap between knowledge and the practical application of safety that these researchers unearthed can also be found in the operations in the Thi-Qar Oil Field.

Successful implementation of safety protocols requires far more than mere employee compliance, however. Nothing less than a complete cultural transformation will suffice. Employees must understand the very real reasons why they are being asked to alter behaviours and must buy into the program and its goals at an emotional level. They must see the program as a personal benefit and not just as a set of instructions to be followed at work and a draconian set of penalties that might be imposed for not following them. Successful safety programs transcend the simple teaching of safety procedures. They get at the heart of why those safety procedures are necessary and why the program itself is a good thing for employees.

Assessing the current compliance of safety protocols in the Thi-Qar Oil Field finds a mixed bag of adherence. Some operations may be safe, but many should be rigorously tested before they are labelled as such. Common reasons given for this lack of compliance include insufficient personnel trained in safety protocols, certainly not enough to cover the vast number of oil and gas operators, and a lack of enforcement both at the company and government level. But the most significant factor might just be the oil-field culture—an attitude of safety second. We are conditioned to think of the oil industry as the land where safe is a four-letter word. Regular safety audits and assessments could identify some of these problems, and regular safety training for all employees could begin to close the gaping compliance deficit. If we are serious about changing the culture in the oil field from "safety second" to "safety first," we need to open the conversation about the current lack of compliance to anyone who will listen.

To sum up, making the oil field safer is a matter of training, of teaching the people who work there to understand and follow the kind of protocols that make industry accidents much less likely. International research on this subject shows that safety compliance has a direct relationship with safety outcomes. So in the oil field, if workers are following safety procedures with a high degree of fidelity, the chances of there being an accident drop significantly.

Engineers' Perception and Attitudes Towards Safety Systems

In the Thi-Qar Oil Field, the engineers' perception and attitude toward safety systems is of utmost importance to the overall safety picture. Directly involved in the planning, execution, and management of operations, engineers have a huge say in the what, how, and even why of safety protocol. If the safety protocol is a success, it is largely because the engineers made the decision to implement it in the first place. If it fails, it is largely because the engineers involved in its implementation did not buy into the concept for one reason or another.

An important study by França, Zeffass, and Silveira (2020) underscores the absolute necessity of cooperation between safety engineers and geoscientists to establish a robust culture of safety. The result from bringing safety engineers into geological fieldwork where, for example, compliance with OSHA regulations is most strictly needed demonstrates that we can dramatically improve safety awareness and compliance when engineers and geoscientists work together. Field study conducted in Brazil, South Africa, and Argentina revealed that interdisciplinary collaboration substantially improved the safety practices and attitudes of geology students and faculty.

In the same way, Zhao et al. (2019) focused on the safety attitudes of health professionals in Chinese hospitals. They used the Safety Attitudes and Safety Climate Questionnaire, an instrument developed for the healthcare sector, to take the measure of the nearly 500 hospital staff who participated in their study. Despite the study's healthcare focus, the insights gained from it are relevant to any high-risk work environment, including oil fields. When it comes to understanding who has what kind of safety attitude, the researchers found that demographics play a significant role: male/female, age, and prior safety training shape safety perceptions. Hospital professionals who are younger, female,

and have received safety training are much more likely to have positive safety attitudes. These group differences in safety attitudes should also exist among engineers working in the Thi-Qar Oil Field in southern Iraq.

The insights provided by Bjällmark and colleagues (2024) from their study on interventional radiology professionals in Sweden are relevant here. They administered a modified Safety Attitudes Questionnaire to a convenient sample of professionals from that discipline. They found that, of the attendees who completed the survey, job satisfaction and the climate for teamwork were perceived at the high end of the scale. Not far behind these two dimensions, safety and the understanding of the importance of safety also scored relatively high—certainly not very low. However, the dimension that scored the lowest was stress recognition, or the understanding that high levels of stress can interfere with the safe performance of individuals and teams. Significantly, the psychosocial stressors that the people who live and work in the Thi-Qar Oil Field are under could be affecting the safety climate. If performance is safe, that is a good thing. If performance is not safe and is affected by stress, there's a problem.

These investigations indicate that engineers' attitudes toward safety systems are complex and multifaceted. Collaborative practices, demographic factors, and different workplace stressors all seem to influence how engineers view safety. Teamwork that encompasses different disciplines, such as that seen in França et al.'s (2020) study, seems to be a context in which shared safety culture is more likely to occur. Addressing demographic differences, as Zhao et al. (2019) highlight, makes safety training more effective. Using insights from Bjällmark et al. (2024), it's also evident that recognizing and ameliorating stress helps engineers work safely.

In the specific case of the Thi-Qar Oil Field, the influences on safety system perception are multidimensional and muddlers engineering culture. This is a safety culture that broadly aligns with global safety standards and best practices but has significant room for improvement, particularly in the areas of demographic inclusivity and stress awareness. Within engineering cultures more broadly, these problems make it less likely that a safety system will be perceived as something one should embrace and, instead, more likely that a safety system will be perceived as something one can either accept or reject without any significant consequences.

Therefore, for the successful implementation of safety systems in the Thi-Qar Oil Field, a comprehensive strategy that encompasses collaborative practices, demographic sensitivity, and stress management is necessary. Such an approach would not only improve individual safety attitudes but also elevate the overall safety climate, minimizing the risk of accidents and ensuring smoother, safer operations.

Discussion

Safety in the oil and gas sector, especially in difficult places like the Thi-Qar oil field in Iraq, is vital. Ensuring good safety practices is fundamental to keeping the many inevitable risks associated with oil wells under control and to keeping the health of the many workers who labor in such places as safe as possible. Several problems continue to trouble e-governance. One is the ongoing need to customize safety systems to fit local conditions. Another is the technological infrastructure required to support them. Yet a third is the qualified personnel needed to make the hardware and software function properly. Another key area is worker safety training, where effective mentoring in the field of occupational safety and health (OSH) has the potential to elevate training to a much more useful level. Opito accreditation has done a lot to push upward the standard of training and has provided a lot of guidance to areas that need it in terms of how to make basic safety training more effective. Nonetheless, many areas of the effective implementation of training programs still need to be addressed before we can consider the mentoring model and the programs it serves as effective.

From an engineering perspective, what is essential is not just the Incident Management System (IMS) itself but its flexibility to adapt safety protocols to the specific operational challenges of the Thi-Qar field. Enabling not just any engineers but specifically those in the district to undertake management and decision-making roles crucially adds to the incident prevention and makes the safety net stronger. Continuous hazard assessments performed by field engineers, vigorous even by 2023 standards, identify potential risks and advocate necessary precautions, way ahead of any incident.

Substantial advancements have made that came from taking the proactive engineering path. We have applied and integrated new technologies, including real-time monitoring and predictive analytics, into our risk response and management strategies. These technologies have given us the capability to do risk we now manage much better than we did in the past.

To sum up, the Thi-Qar Oil Field has made important strides in recent years in the areas of system safety and operator training. Yet, the oil field still faces significant challenges— notably, low safety outcomes for its employees and the communities that surround it. Two are worth noting because they are so contrary to the safety philosophy we are

taught: employees in the Thi-Qar Oil Field do not receive crisis-management training, and they do not conduct regular safety drills.

Conclusion

The study deeply investigates the safety systems in the oil and gas industry, particularly in the Thi-Qar oil field in Iraq. It centres on the responses of engineers who work there to the safety protocols set forth by their employers. What comes through in the analysis is the not-so-simple management of safety in a complex environment rife with certain well-known (but no less unfortunate) challenges. Despite the presence of safety professionals, the safety culture in this region is undeniably influenced by certain intrinsic and extrinsic factors that go well beyond the safety professionals who are trying to do a good job and keep people safe.

The research also investigates on two things that are vital to the achievement of safety in the corporate world: solid employee training and the strict enforcement of safety protocols. The study yielded some clear messages: Incidents, as unfortunate as they are, happen for a reason (or several reasons). By examining the why behind an incident, we can identify areas within our safety management systems that need attention; these areas are sometimes referred to as "nonconformances."

Lastly this study highlights the importance of thorough training, teamwork among various disciplines, and the use of new technology to solve the safety problems in the Thi-Qar oil field. Most important, though, the study makes clear that the need for these solutions gives the people who work in the oil field a very good reason to take serious the need for a safety culture. The industry here in Iraq has a good opportunity to enhance its safety record. It can do that not only as an obligation to the people who work in the field but also as much needed payback in fostering good environmental relationships.

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