EXPLORING HUMAN PERFORMANCE FACTORS INFLUENCING UNDERSTANDING OF SAFEGUARDS AMONG OFFSHORE WORKFORCES IN TERENGGANU

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Abstrak

Operasi luar pantai dijalankan dalam persekitaran kerja berisiko tinggi yang memerlukan pengurusan keselamatan yang berkesan bagi mencegah kecederaan cacat kekal dan kemalangan maut. Walaupun pelbagai polisi dan prosedur keselamatan telah ditetapkan, pelaksanaan di lapangan sering menunjukkan ketidakselarasan antara keperluan keselamatan formal dengan amalan sebenar semasa kerja dijalankan. Ketidakselarasan ini sebahagian besarnya dipengaruhi oleh faktor prestasi manusia serta cara tenaga kerja memahami dan berinteraksi dengan perlindungan kritikal semasa melaksanakan tugasan berisiko tinggi. Kajian ini menggunakan reka bentuk kajian kes kualitatif untuk meneliti bagaimana faktor prestasi manusia mempengaruhi pemahaman terhadap perlindungan kritikal, khususnya dari sudut pengesahan kewujudan dan kefungsian perlindungan dalam konteks operasi sebenar. Pengumpulan data dilaksanakan melalui lapan sesi pemerhatian tanpa penyertaan di lapangan industri luar Pantai minyak dan gas. Pemerhatian dijalankan menggunakan Senarai Semak Pemerhatian Pengesahan dan Validasi berstruktur yang menyokong interaksi langsung bagi mendokumentasikan amalan kerja sebenar. Pendekatan ini menekankan pemerhatian terhadap kerja dan mengurangkan kebergantungan kepada audit dokumentasi yang mencerminkan yang dibayangkan. Hasil kajian menunjukkan wujudnya jurang yang konsisten antara protokol keselamatan yang dirancang dengan pelaksanaan di lapangan. Walaupun kewujudan perlindungan lazimnya disahkan sebelum kerja dimulakan, aspek kefungsian perlindungan apabila diperlukan tidak sentiasa diberi perhatian yang mencukupi. Selain itu, dapatan menunjukkan bahawa pemahaman yang terhad serta penggunaan peralatan keselamatan secara ritual telah menyebabkan perlindungan dianggap sebagai keperluan pematuhan prosedur, dan bukannya sebagai mekanisme kawalan risiko yang aktif. Kajian ini menyimpulkan bahawa peningkatan keberkesanan perlindungan memerlukan peralihan daripada pendekatan pematuhan prosedur kepada pembudayaan keselamatan yang lebih proaktif dan generatif. Peranan penyelia barisan hadapan dikenal pasti sebagai elemen penting dalam memastikan pengesahan perlindungan dilakukan secara fungsian pada peringkat operasi, sejajar dengan risiko sebenar yang dihadapi.

Kata Kunci: Prestasi Manusia, Perlindungan, Pengesahan Perlindunagn, Kerja Selesai, Keselamatan Luar Pantai.

Abstract

Offshore operations are conducted in high risk working environments that require effective safety management to prevent serious injuries and fatal accidents. Establishment of numerous safety policies and procedures, field implementation frequently shows misalignment between formal safety requirements and actual work practices. This misalignment is largely influenced by human performance factors and the manner in which the workforce understands and interacts with critical safeguards during the execution of high-risk tasks. This study used a qualitative case study design to examine how human performance factors influence the understanding of safeguards, particularly in terms of verifying their presence and functional effectiveness within real operational contexts. Data collection was carried out through eight non-participant observation sessions conducted at an offshore oil and gas industrial site. Observations were guided by a structured Verification and Validation Observation Checklist that supported direct interaction to document actual work practices. This approach prioritised the observation of work as performed, while reducing dependence on documentation audits that reflect work as imagined. The findings indicate a persistent gap between planned safety protocols and their implementation in the field. Although the presence of safeguards is commonly verified prior to task execution, sufficient attention is not consistently given to ensuring that these safeguards will function effectively when required. Furthermore, limited understanding and the ritualistic use of safety equipment have resulted in safeguards being perceived primarily as procedural compliance requirements rather than as active risk control mechanisms. This study concludes that enhancing safeguard effectiveness requires a shift from a procedural compliance-based approach towards a more proactive and generative safety culture. The role of Front-Line Supervisors is identified as a critical element in ensuring that safeguards are functionally verified at the operational level, in alignment with the actual risks encountered during offshore activities.

Keywords: Human Performance, Safeguards, Safeguard Verification, Work-as-Done, Offshore Safety.

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List of Abbreviations

AHU	Air Handling Unit
AAR	After-Action Review
BOSIET	Basic Offshore Safety Induction and Emergency Training
FAR	Fatal Accident Rate
FLS	First Line Supervisor
FOET	Further Offshore Emergency Training
HRO	High Reliability Organisation
HP	Human Performance
HSE	Health and Safety Executive (UK)
HVAC	Heating, Ventilation, and Air Conditioning
IMCA	International Marine Contractors Association
IOGP	International Association of Oil & Gas Producers
JSA	Job Safety Analysis
LEL	Lower Explosive Limit
LOTO	Lock Out / Tag Out
LSR	Life Saving Rules
LTIF	Lost Time Injury Frequency
OCIMF	Oil Companies International Marine Forum
OPITO	Offshore Petroleum Industry Training Organization
PGD	Portable Gas Detector

PIF	Performance-Influencing Factor
PTW	Permit to Work
SWA	Stop-Work Authority
SWC	Start Work Check
TRIR	Total Recordable Injury Rate
VnV	Verification and Validation
WAD	Work-as-Done
WAI	Work-as-Imagined

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

The offshore industry encompasses oil and gas exploration, drilling, production, construction, commissioning, and transportation activities, all of which are conducted in inherently hazardous and high-risk environments. These operational conditions demand current governance structures, stringent safety standards, disciplined execution, effective risk management, and reliable emergency response arrangements. Continuous advancements in technology, operational processes, and formal safety systems, offshore operations continue to experience serious injuries and fatalities, indicating that technical and procedural controls alone are insufficient to ensure safety at the point of risk. Recent industry data highlight a persistent misalignment between organisational safety expectations and actual worksite practices. In 2024, industry reports documented multiple fatalities alongside increases in both Total Recordable Injury Rates (TRIR) and Lost Time Injury Frequency (LTIF), signalling ongoing weaknesses in safety performance. Regulatory inspections have similarly identified gaps between written safety policies and their execution in the field. These trends suggest that the underlying issue extends beyond the adequacy of formal safety systems and points instead to challenges associated with human performance, particularly in how workforces verify the presence of safeguards and validate their functional effectiveness during high-risk tasks.

Safeguards, also referred to as safety barriers, are fundamental components of offshore risk control strategies designed to prevent Life-Altering Injuries and Fatalities. However, evidence indicates that safeguards are often treated as procedural requirements to be checked for compliance rather than as critical controls that must be verified for functional integrity under real operating conditions. This distinction is especially significant for high-risk activities such as breaking containment, energy isolation, confined space entry, hot work, mechanical lifting, working at height, and line-of-fire exposure, where safeguard failure can result in catastrophic outcomes. While management systems and technical solutions provide the structural foundation for safety, their effectiveness ultimately depends on how individuals and teams interpret, apply, and act upon them at the worksite. Human performance factors including knowledge, situational awareness, motivation, engagement, and behavioural norms plays a decisive role in shaping safety outcomes. Industry initiatives such as Start Work Checks (SWC) and updated Life-Saving Rules have been introduced to strengthen frontline verification of safeguards by requiring workers to confirm that critical controls are present and capable of functioning before work commences. When applied effectively, such practices enhance frontline ownership of safety and support the exercise of Stop Work Authority, thereby helping to bridge the gap between Work-as-Imagined and Work-as-Done.

Human performance principles emphasise that error is an inherent aspect of human activity, and that safety is improved not by eliminating error, but by understanding, anticipating, and managing it where it matters most. Persistent discrepancies between documented safety requirements and actual workforce behaviour indicate that safeguards are not always fully understood or functionally validated in practice. This gap is particularly concerning in high-consequence operational contexts where

safeguard failure can have irreversible outcomes. Leadership responses, especially at the frontline supervisory level, play a critical role in shaping safety culture, influencing how safeguards are interpreted, verified, and prioritised during task execution. This study examines how human performance factors influence the workforce's understanding and functional verification of safeguards in offshore operations. By focusing on real work practices rather than solely on formal systems, the study finds to contribute empirical insight into how safeguard integrity is maintained or compromised at the operational level, and how human performance approaches can be strengthened to prevent Life-Altering Injuries and Fatalities.

Table 1.1
Human Performance Principles

No.	Principle	Key focus (summary)
1	People make mistakes	Accept human fallibility and add safeguards to catch errors early
2	Well-meaning actions can cause mistakes	Clarify expectations and manage deviations so "getting the job done" stays within safeguards
3	Conditions drive error-prone situations	Identify and mitigate underlying conditions that increase error likelihood
4	Learn how and why mistakes occur	Analyse events/near misses and apply lessons to prevent recurrence
5	Predict and manage error-prone situations	Use task analysis and safeguards to prevent or control most error risks
6	Leaders' responses shape culture	Respond to mistakes in ways that promote learning and accountability

1.2 Problem Statement

The offshore industry operates in environments where high risk tasks are routinely performed, and the consequences of failure can be severe. Safety Management Systems and technical safeguards are widely applied to control these risks, yet serious incidents continue to occur. This suggests that having safeguards in place does not always mean that they are understood, applied, or capable of functioning effectively

during task execution. In practice, safety assurance at worksites often focuses on confirming that safeguards exist rather than on how they are applied by the workforce or whether they can be shown to work when needed. Management reviews and audits commonly reflect documented procedures and expected practices, while limited attention is given to how work is carried out in real operating conditions. As a result, there is reduced visibility into how workers identify required safeguards, how they apply them during high-risk tasks, and how they judge whether those safeguards can function before a task reaches a point where recovery is no longer possible.

Safety tools such as the Start Work Check (SWC) are intended to support frontline verification of safeguards before work begins. However, when these tools are used as routine checklists, the depth and accuracy of safeguard verification may be reduced. In such cases, safeguards may be treated as procedural requirements rather than as active controls that manage risk at the point of work. There is limited observational evidence showing how offshore workforces demonstrate the application of safeguards at the worksite, how they define which safeguards are required for specific high-risk tasks, and how they behaviourally validate that a safeguard will work on demand. This lack of evidence restricts understanding of how human performance influences safeguard effectiveness during offshore operations.

This study addresses this gap by examining safeguard application through direct observation of work activities, focusing on workforce behaviour, verification practices, and the influence of safety tool use on safeguard understanding at the point of risk.

1.3 Research Questions

i. How do offshore workforces demonstrate the application of safeguards during worksite activities?

ii. How do offshore workforces define and identify the safeguards that need to be in place before carrying out high-risk tasks?

iii. What observable behaviours indicate how offshore workforces validate that safeguards will function when required during task execution?

iv. How does the routine use of safety tools, such as the Start Work Check (SWC), shape the way safeguards are verified at the point of risk?

1.4 Research Objectives

1.4.1 General Objective

To explore human performance factors influencing understanding of Safeguards among offshore workforces in Terengganu.

1.4.2 Specific Objectives

i. To observe how offshore workforces apply safeguards during worksite activities.

ii. To explore how offshore workforces define and identify the safeguards required before carrying out high-risk tasks.

iii. To examine the behavioural practices used by offshore workforces to validate whether safeguards can function when required during task execution.

iv. To examine how the routine use of safety tools, such as the Start Work Check (SWC), influences safeguard verification at the point of risk.

1.5 Scope and Limitation of the Study

This study focuses on human performance factors influencing the application and verification of safeguards in offshore operations. The scope of the research is limited to offshore energy activities where high-risk tasks are performed and safeguards are required to prevent serious injuries and fatalities. The study emphasises the observation of actual work practices at the worksite, rather than formal safety documentation or audit records. The research was conducted through non-participant observations at the Tapis offshore field in Terengganu, Malaysia. Observations were carried out across selected offshore platforms during a defined study period. The study involved frontline offshore personnel, including technicians, operators, and lifting personnel, who are directly engaged in high-risk operational tasks. Data collection was based on a qualitative case study approach using a structured observation checklist to examine how safeguards are identified, applied, and verified before work execution.

Several limitations of this study should be highlighted. First, the study was limited to a single offshore field, and therefore the findings may not be representative of other offshore installations or industries with different operational contexts. Second, the study adopted a cross-sectional design, capturing work practices at a specific point in time rather than over an extended period. As such, changes in behaviour over time could not be assessed. Third, the presence of an observer may have influenced workforce behaviour during the observation sessions, which could result in more cautious or compliant practices than those normally exhibited. These limitations should be considered when interpreting the findings of the study.

1.6 Definition of Key Terms

1.6.1 Safeguards (Verification and Validation)

These refer to the technical, administrative, and procedural layers of defence designed to prevent or mitigate hazardous events. In this study, the term is bifurcated into Verification, which confirms that a safeguard is physically in place, and Validation, which ensures the barrier is functionally capable of working on demand prior to task execution (Albrechtsen & Tveiten, 2022; Antonsen et al., 2021).

1.6.2 Human Performance (HP)

A multidisciplinary field that examines how workforces interact with organizational systems and processes. The focus is specifically on the cognitive and behavioural factors such as risk perception and situational awareness that determine the ultimate efficacy of safety barriers in high-consequence environments (Patriarca et al., 2021; Roberts & Flin, 2025).

1.6.3 Work-as-Imagined (WAI) vs. Work-as-Done (WAD)

This conceptual paradigm describes the gap between safety tasks as formally documented in standard operating procedures (WAI) and the actual, adaptive practices performed by frontline workforces at the point of risk (WAD). This research investigates how human performance factors bridge this gap to ensure safeguard integrity (Antonsen et al., 2021; Patriarca et al., 2021).

1.6.4 Ritualization

A phenomenon where organizational safety tools, such as checklists, become decoupled from their intended risk-mitigation goals. This results in a "tick-box" mentality where administrative compliance is prioritized over the meaningful

behavioural verification of whether a safeguard is functionally reliable (Clarke & Waring, 2024).

1.6.5 Start Work Check (SWC)

A standardized behavioural tool designed to facilitate a critical dialogue between frontline workforces and supervisors. It serves as the primary mechanism for the functional validation of life-critical safeguards immediately before high-risk activities begin (Albrechtsen & Tveiten, 2022). Here is the impact and case review, whereby Start Work Check are peer completed, standardised checklists used immediately before work begins to confirm that all life critical safeguards are in place (IOGP, 2025a; IOGP, 2022). They directly support IOGP's Life Saving Rules and are designed to be owned and led by frontline workforces at the worksite.

1.7 Organization of the Thesis

This thesis is structured into five chapters. Chapter 1 introduces the study by presenting the background of the research, problem statement, research questions, research objectives, scope and limitations of the study, and the overall structure of the thesis. This chapter establishes the context and rationale for examining human performance factors influencing the application of safeguards in offshore operations.

Chapter 2 reviews relevant literature related to offshore safety, human performance, safeguards, and safety verification practices. This chapter provides the conceptual foundation for the study and highlights key issues and gaps in existing research that inform the focus of the present study. Chapter 3 outlines the research methodology adopted in this study. It describes the qualitative case study design, research setting, participant selection, data collection procedures, and the observation approach used to examine safeguard application and verification at the worksite. Data analysis procedures are also presented in this chapter. Chapter 4 presents the findings of the

study based on the observation data collected. The chapter reports key themes and patterns related to workforce behaviour, safeguard application, and verification practices. The findings are discussed in relation to the research questions and relevant literature. Chapter 5 concludes the thesis by summarising the main findings of the study, discussing their implications for offshore safety practice and human performance, and providing recommendations for future research.

CHAPTER 2

LITERATURE REVIEW

This chapter reviews relevant literature on human performance and the use of safeguards in offshore operations. It provides the conceptual background for the study by examining how safety is managed in high-risk offshore environments and how work is carried out in practice. The review focuses on issues related to workforce behaviour, safeguard application, and the gap between documented safety requirements and actual work practices at the worksite. By drawing on existing studies in safety management and human factors, this chapter highlights areas where current approaches provide limited insight into how safeguards are verified and used during real operational conditions. These gaps support the need for a qualitative, observation-based study that examines safeguard functionality and workforce practices in offshore settings.

2.1 Human Performance in High Risk Environments

Human performance has long been recognised as a critical factor influencing safety outcomes in high-risk industries such as aviation, nuclear power, healthcare, and offshore energy operations. Early safety research often framed human error as the primary cause of accidents; however, contemporary safety science views human performance as a necessary and adaptive response to complex and dynamic work environments rather than as a source of failure alone (Reason, 1997; Dekker, 2014). In high-risk settings, workers are required to make continuous judgments under time pressure, uncertainty, and changing operational conditions, which shapes how tasks are carried out in practice. Research in resilience engineering highlights that safety is

not solely produced through rules, procedures, or technical controls, but through the capacity of people and systems to adapt to variability in real work situations (Hollnagel, 2014). Human performance therefore plays a dual role: it can contribute to successful operations under difficult conditions, but it can also introduce risk when system constraints, inadequate resources, or competing priorities influence behaviour. Understanding how workers perform tasks in real operational contexts is thus essential for managing safety in high-hazard environments.

In offshore operations, human performance is particularly critical due to the presence of hazardous energy sources, confined spaces, heavy lifting activities, and complex process systems. The consequences of error can be severe, often resulting in Life-Altering Injuries or Fatalities. As such, modern safety research increasingly emphasises the need to understand how human behaviour interacts with safety systems and safeguards at the point of risk (Flin et al., 2008).

2.2 Work-as-Imagined and Work-as-Done

A key concept in modern safety science is the distinction between Work-as-Imagined (WAI) and Work-as-Done (WAD). WAI refers to how work is assumed to be performed according to procedures, policies, and safety management systems, while WAD reflects how work is carried out by the workforce in real operating conditions (Hollnagel, 2012). This distinction highlights the gap between formal safety expectations and practical execution. Studies show that work rarely follows procedures exactly as written, particularly in complex and high-risk environments. Instead, workers adapt their actions to local conditions, equipment limitations, and time pressures in order to complete tasks successfully (Dekker, 2011; Shorrock, 2021). These adaptations are not inherently unsafe; in many cases, they are necessary to

maintain operational continuity. However, when such adaptations involve bypassing or weakening safeguards, the level of risk can increase without being visible to management.

Safety assurance processes such as audits and inspections often focus on WAI by checking documentation and procedural compliance. While these processes are important, they provide limited insight into WAD and may fail to detect how safeguards are actually applied during task execution (Hollnagel, 2014). This gap between documented compliance and real work practices has been identified as a persistent challenge in high-risk industries, including offshore operations (Antonsen et al., 2021).

2.3 Safeguards in Offshore Operations

Safeguards in offshore operations combine technical devices, administrative procedures and human actions intended to prevent hazards from escalating into major incidents. Recent industry guidance emphasises simplified, frontline-focused checks that list critical controls which must be present and capable of functioning before work starts. For example, IOGP's Start Work Checks (SWC) guidance, which frames SWCs as short, standardised checks performed at the job site with a verifier/peer review step to confirm controls. SWCs are designed to increase frontline ownership and to provide immediate verification of critical safeguards prior to high-risk tasks. Despite these designs, evidence from safety research and industry practice shows that the presence of a barrier (verification that something is "in place") does not guarantee that the barrier will perform when required (validation). Offshore practice routinely separates "is it there?" (e.g., equipment on site, paperwork completed) from "will it work now?" (e.g., battery charged, alarm functioning, correct isolation in place). This separation

matters because many controls depend on human action or condition (calibration, correct configuration, peer confirmation) for functional readiness. Studies across high-risk sectors therefore call attention to verification and validation as complementary tasks for true barrier integrity.

2.4 Verification versus Validation: an operational lens

Verification and validation are distinct but related activities. In operational practice, verification typically refers to checking for the physical presence of a safeguard (checklist tick, equipment located), while validation refers to confirming that the item will perform under operational conditions (functional test, calibration check, demonstrable alarm). Industry and academic reviews highlight that verification on its own can create false assurance if it is not paired with quick, practical validation steps at the point of work (e.g., a lightweight functional test). Where validation is absent, management sees "paper compliance" while frontline reality may hide latent failures that only surface under load. The literature therefore recommends designing verification workflows that include simple validation actions appropriate to the task and time available, especially for life-critical controls.

2.5 Human performance factors affecting safeguard understanding and validation

Human performance factors including training and competency, experience and tacit knowledge, situational awareness, communication, and production pressure which shape whether safeguards are identified, applied, and validated in practice. Training and competency initiatives improve workers' ability to recognise safeguard failure modes and to carry out on-site validation steps; several recent studies show that targeted supervisor coaching and safety-leadership interventions produce measurable

changes in frontline verification behaviours. For example, are improved use of checklists, more frequent peer verification.

Experience and local practical knowledge (tacit knowledge) influence how workers interpret checklist items and adjust validation behaviours when equipment or conditions differ from the ideal. Communication and co-ordination (including use of a verifier or peer) matter: SWC guidance explicitly builds a verifier role to create two pairs of eyes and reduce individual error. Where communication breaks down or where teams normalise minor deviations, safeguards risk becoming administrative artefacts rather than functioning defences. Situational factors are complexity of the task, environmental variability, schedule pressure, and fatigue which create "error-prone situations." Recent resilience-oriented studies recommend mapping such situations and embedding simple validation actions (hold points, trigger checks) before irreversible steps. Practical resilience methods have been used to align imagined procedures with actual practice and to identify where lightweight validation steps can be inserted without disrupting workflow.

2.6 Safety tools and the problem of checklist ritualisation

Checklists and standardised tools (SWC, permit systems, hold/trigger points) are necessary but can become ritualised. Recent qualitative research across healthcare and high-risk industries documents how checklists, when used as administrative routines, can lose their intent and become "tick-box" exercises that provide managerial reassurance but no functional validation. For example, are surgical checklist studies showing ritualisation effects). Reimplementation studies show that checklist use can be re-embedded as meaningful practice if accompanied by coaching, simple functional tests, and a verifier role that demands demonstration rather than just affirmation.

Where SWCs or hold/trigger points are implemented without accompanying supervisor coaching or without simple “show me / tell me” validation steps, the literature warns that the qualitative depth of verification declines: workers may confirm presence on a form but not perform quick tests that demonstrate functioning. Industry guidance and implementation reviews therefore emphasise that SWCs are most effective when coupled with a verifier role, simple functional checks, and leadership behaviours that treat validation as a coaching opportunity rather than a paperwork exercise.

Industry data further demonstrate that improving the consistent use of safeguards, particularly through Start Work Check, is associated with reductions in serious incidents. The following table summarises changes in Fatal Accident Rate (FAR) and Total Recordable Injury Rate (TRIR) before and after Start Work Check (SWC) implementation. Impact of Start Work Check (SWC) on Offshore Safety Metrics. Table 2.1 below shows that the implementation of Start Work Check (SWC)s corresponds with reductions in both fatal accidents and recordable injuries, based on data adapted from IOGP (2025a) and few examples from case study in industry.

Table 2.1
Fatal Accident Rate (FAR) and Total Recordable Injury Rate (TRIR)

Metric	Before SWC	After SWC
FAR	0.09	0.08
TRIR	0.29	0.25

Case Example 1: Chevron North Sea

Chevron North Sea introduced Start Work Check (SWC)s for all lifting activities. Within one year, the site reported fewer near misses and an 11% reduction in TRIR. In one documented case, a maintenance team stopped work after identifying missing sling certification during the Start Work Check (SWC), preventing a potential dropped object incident that could have been fatal (IOGP, 2022).

Case Example 2: Schlumberger

Schlumberger integrated Start Work Check (SWC) into its well intervention routines, including peer verification of safety-critical steps. Over 12 months, the company recorded a 9% reduction in lost time injuries and attributed this improvement partly to stronger behavioural ownership and more proactive hazard reporting associated with Start Work Check (SWC)s (IOGP, 2022). A graphical presentation of these kinds of improvements is provided in Figure 2.1 Impact of Start Work Check (SWC) on Offshore Safety Metrics. To visualize these findings, see the chart below:

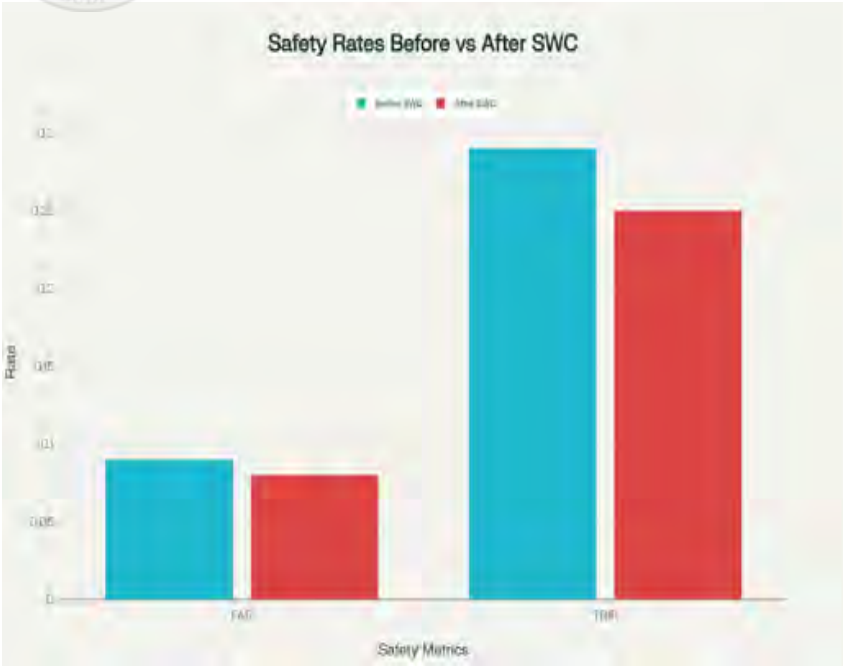

Figure 2.1 Impact of Start Work Check (SWC) on Offshore Safety Metrics

2.7 Frontline leadership, verification dialogues and practical interventions

Frontline supervisors (First Line Supervisors) are repeatedly identified in recent empirical studies as essential actors in turning checklists into functional validation practices. Training programs that focus on safety leadership and coaching have been shown to improve supervisors' ability to facilitate verification dialogues, encourage Stop Work Authority use, and detect weak signals earlier. These interventions work by shifting interactions from a compliance audit to a short coaching-style exchange: a "show me" demonstration of functionality and a "tell me" explanation of what would happen if the safeguard failed. Evidence suggests this approach reduces ritualised checklist responses and increases fidelity of verification in the field.

2.8 Summary of the Research Gap

The critical synthesis of existing literature underscores a significant disconnect between the design of Safety Management Systems (SMS) and the behavioural reality of their execution in high-hazard offshore environments. While the industry has established robust technical and administrative barriers, the persistent occurrence of incidents suggests a profound "observational void" that remains unaddressed by traditional safety metrics. The primary gap in current knowledge stems from an over-reliance on "Work-as-Imagined" (WAI), where idealized procedural compliance is assumed to equate to risk mitigation (Hollnagel, 2022; Shorrock, 2021). Current research often fails to capture the "Work-as-Done" (WAD) reality the adaptive, messy practices through which workforces navigate resource constraints and production pressures on aging platforms, such as those in the Tapis field (Antonsen et al., 2021; Zolkeply et al., 2025).

A second, more critical gap lies in the conceptual and practical conflation of safeguard presence with safeguard functionality. Existing studies frequently examine barrier management through a static lens, focusing on whether a safeguard is physically "in place" (Verification). However, there is a distinct lack of empirical evidence regarding the behavioural processes required to ensure a safeguard is "working on demand" (Validation) at the point of risk (Albrechtsen & Tveiten, 2022; Zulkifly et al., 2026). This distinction is vital; a safeguard that is verified as present but not validated as functional provides only an illusion of safety, contributing to a systemic "uncontrolled drift" that administrative audits are ill-equipped to detect (Patriarca et al., 2021; Zolkeply et al., 2025).

Furthermore, the literature identifies the phenomenon of "ritualization" as a major inhibitor of safeguard integrity, yet qualitative explorations of this phenomenon in the offshore sector are scarce. Most industry research is dominated by quantitative lagging indicators, such as Total Recordable Injury Rates (TRIR), which provide no insight into the cognitive decoupling that occurs when compliance becomes a "tick-box" exercise (Clarke & Waring, 2024; Provan et al., 2021). There is a clear need to investigate how high-pressure organizational cultures drive workforces to prioritize administrative speed over meaningful functional verification, effectively masking latent failures from management oversight (Antonsen et al., 2021; Yee & Zolkipli, 2021).

Finally, while the role of the First Line Supervisor (FLS) is recognized as a cultural gatekeeper, the specific behavioural interactions that foster "cognitive ownership" remain under-researched. Current literature advocates for "critical dialogues," but there is minimal "thick description" of how "show me and tell me" interactions

actually manifest during live high-risk tasks like energy isolation or hot work (Roberts & Flin, 2025; Zulkifly et al., 2026). This study addresses these cumulative gaps by moving beyond paper-based metrics to provide real-time, qualitative observations of safeguard integrity. By focusing on the functional validation of life-critical safeguards in the specific socio-technical context of the Tapis field, this research offers a unique contribution to the understanding of how human performance determines the resilience of organizational defences (Albrechtsen & Tveiten, 2022; Zolkeply et al., 2025; Zulkifly et al., 2026).

2.9 Summary of Chapter

This chapter has reviewed theoretical perspectives on human performance in high-risk environments, key safeguard mechanisms in offshore operations, and the human factors that influence safeguard understanding and use. The review highlighted empirical evidence on Start Work Check (SWC)s, hold points, trigger points, and stop-work authority, while identifying gaps in observation-based research on how frontline workers actually apply these tools in practice. These insights underpin the study's conceptual and theoretical framework and inform the qualitative observational methodology employed to explore human performance factors influencing workers'' understanding of safeguards in the offshore industry.

Table 2.2
Research Gap Analysis

No	Research Gap	Theoretical/Contextual Limitation	References
1	The Observational Void	Traditional audits focus on administrative compliance (WAI) rather than adaptive site reality (WAD), leaving management blind to localize "workarounds."	Hollnagel (2022); Antonsen et al. (2021); Shorrock (2021)
2	Verification vs. Validation Deficit	Significant research exists on barrier *presence*, but a gap remains in understanding the behavioural *validation* of functional readiness at the point of risk.	Albrechtsen & Tveiten (2022); Zolkeply et al. (2025); Zulkifly et al. (2026)
3	Ritualization of Safety Tools	Administrative tools like SWC and PTW become "tick-box" rituals that mask operational risks and decouple compliance from actual risk mitigation.	Clarke & Waring (2024); Nilsen et al. (2023); Provan et al. (2021)
4	Information Integrity and "Gotcha" Culture	Socio-technical systems are undermined when workforces provide ritualized, defensive data to satisfy audits, obscuring the true state of barrier health.	Yee & Zolkipli (2021); Zolkeply et al. (2025)
5	Lack of Qualitative Behavioural Data	Heavy industry reliance on quantitative lagging indicators (TRIR) fails to capture the cognitive ownership and "show me/tell me" dynamics of frontline leadership.	Roberts & Flin (2025); Patriarca et al. (2021); Zulkifly et al. (2026)
6	Contextual Specificity in Aging Assets	Lack of research on how human performance adapts to the unique technical challenges and safeguard limitations of aging platforms in Malaysia.	Antonsen et al. (2021); Zolkeply et al. (2025)

CHAPTER 3

METHODOLOGY

This chapter outlines the research methodology used in this study. A qualitative case study approach was adopted to examine how human performance factors influence the application and verification of safeguards in offshore operations. The study focuses on observing actual work practices at the worksite, rather than relying on documented procedures or audit records. Data were collected through non-participant observations conducted at the Tapis offshore field. The observations examined whether safeguards were present and how the workforce demonstrated that these safeguards could function when required. A structured observation checklist was used to support data collection. The methods described in this chapter provide a clear basis for addressing the research questions and objectives of the study.

3.1 Research Framework

The research framework provides a structured approach for examining how human performance influences the application and verification of safeguards in offshore operations. It is designed to address the problem identified in this study, where safeguards are often confirmed as being present but are not consistently demonstrated to function when required. The framework supports the study's focus on observed work practices and behavioural evidence at the worksite, in line with the research questions and objectives.

3.1.1 Theoretical Framework

This study used by the Swiss Cheese Model and Human Error Theory, which are widely used to understand safety performance in high-risk industries. The Swiss Cheese Model explains safety as a system of multiple defensive layers, including technical, procedural, and human elements, where failures occur when weaknesses across these layers align. In the context of this study, these weaknesses are viewed as situations where safeguards exist in form but are not verified for functional effectiveness during task execution. Human Error Theory complements this perspective by recognising that frontline errors are often shaped by underlying organisational and contextual conditions rather than individual negligence. Factors such as training quality, work pressure, routine practices, and the use of standardised safety tools influence how safeguards are understood and applied in practice. These theories allow the study to focus on behaviour and system interactions, rather than assigning blame to individuals.

The framework was selected because it aligns directly with the study's aim to observe how safeguards are applied and validated at the worksite as Figure 3.1. It supports the examination of workforce behaviour, the use of safety tools such as Start Work Checks, and the role of human performance in ensuring that safeguards are capable of functioning at the point of risk. By applying this framework, the study provides a clear basis for analysing observed practices and addressing the gap between formal safety requirements and actual offshore work activities.

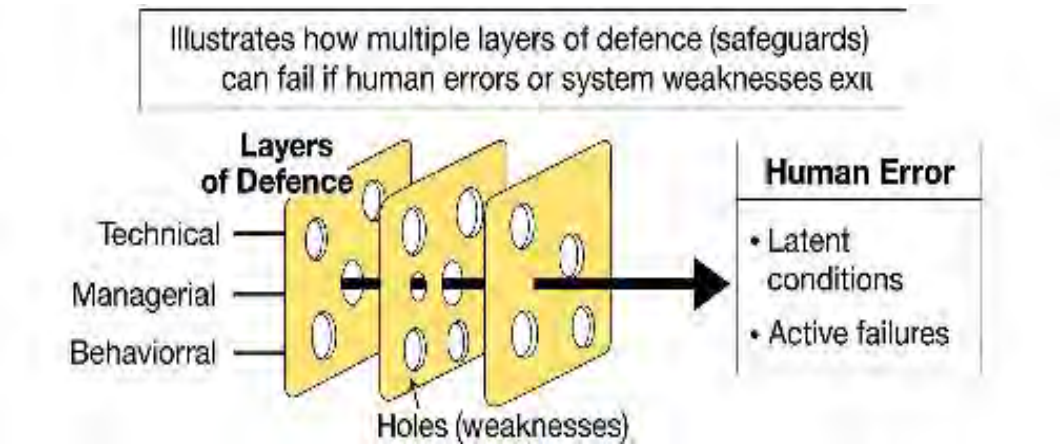

Figure 3.1 Swiss Cheese Model Illustration

3.1.2 Conceptual Framework

This study develops a conceptual framework that focuses on how human performance influences the way safeguards are understood, applied, and verified during offshore work activities. The framework is developed to address the central problem of this study, where safeguards may be present at the worksite but are not consistently demonstrated to function when required. The framework distinguishes between two key aspects of safeguard understanding: verification and validation. Verification refers to confirming that a safeguard is physically in place before work begins, while validation refers to demonstrating that the safeguard is capable of functioning when needed. This distinction is important because workforces may confirm the presence of a safeguard without checking its functional readiness, which can create a false sense of safety at the point of work.

Human performance factors, such as knowledge, experience, situational awareness, and routine work practices, influence how these two aspects are carried out in practice as Figure 3.2. Rather than assuming a direct cause-and-effect relationship, the framework supports an exploratory examination of how workforce behaviour reflects

their understanding of safeguards during task execution. The framework also supports the use of direct observation and the “show me and tell me” Interaction as a way to examine safeguard application in real work settings. By asking workforces to demonstrate and explain how a safeguard works, the study captures behavioural evidence of verification and validation, as well as the depth of understanding at the point of risk. This approach aligns with the qualitative nature of the study and provides a practical lens for analysing observed work practices in offshore operations.

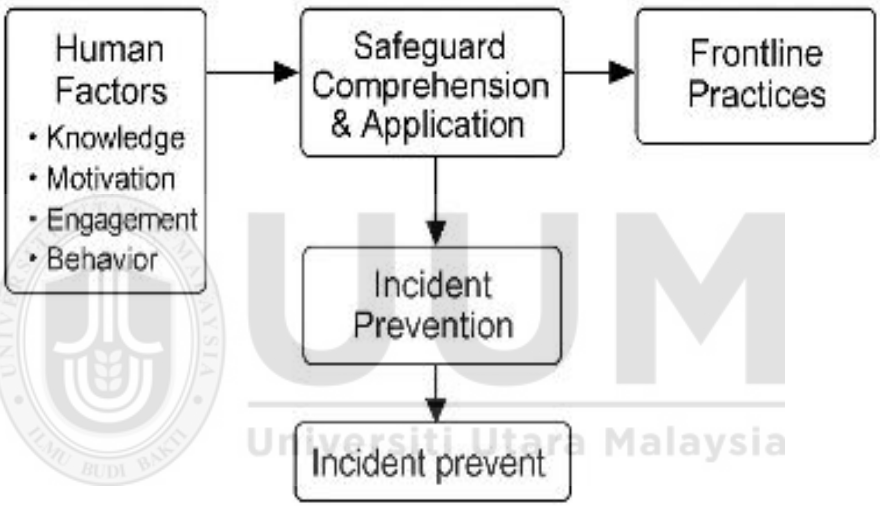

Figure 3.2 Conceptual Frameworks

3.2 Proposition Development

In qualitative research, theoretical propositions are used to guide inquiry and interpretation rather than to test hypotheses or establish statistical relationships. Propositions help direct attention to patterns, behaviours, and conditions that are relevant to the research problem. In this study, the propositions serve as an analytical guide for examining how human performance influences the application and verification of safeguards within the operational context of the Tapis field.

3.2.1 Proposition 1: The Discrepancy between WAI and WAD

The gap between Work-as-Imagined (WAI) and Work-as-Done (WAD) suggests that offshore workforces may confirm that safeguards are physically in place without consistently demonstrating that these safeguards are capable of functioning when required. This proposition focuses on the administrative–behavioural disconnect in which procedural compliance is treated as a formal requirement that is separate from the practical execution of high-risk work activities (Antonsen et al., 2021; Hollnagel, 2022; Patriarca et al., 2021). Within the offshore socio-technical system, procedures are commonly developed under idealised assumptions (WAI), whereas actual work execution (WAD) requires workers to operate under variable conditions such as noise, heat, time pressure, and technical constraints, particularly on ageing facilities such as Tapis-D, Tapis-P, and Tapis-E (Albrechtsen & Tveiten, 2022; Zolkeply et al., 2025). As a result, a safeguard may be verified as present at the worksite, while the behavioural actions required to confirm its functional readiness are not performed. For example, confirming the presence of a gas detector represents verification, whereas conducting a functional alarm test represents validation. Under production pressure or high cognitive load, workers may omit the latter step, assuming that physical presence implies readiness (Shorrock, 2021). The literature highlights that this condition is particularly critical in ageing assets, where technical degradation increases the likelihood of latent failures that are not detected through documentation-based checks alone (Antonsen et al., 2021; Roberts & Flin, 2025). This proposition therefore guides the examination of situations in which the presence of safeguards is incorrectly assumed to equate to functional capability (Albrechtsen & Tveiten, 2022; Zulkifly et al., 2026).

3.2.2 Proposition 2: The Ritualization of Safety Tools

The routine use of safety tools, such as the Start Work Check (SWC), may lead to a checklist-driven approach in which the completion of documentation takes precedence over meaningful verification of safeguard effectiveness. This proposition explores how safety tools can become symbolic compliance mechanisms that satisfy organisational requirements without necessarily contributing to risk control at the point of work (Clarke & Waring, 2024; Provan et al., 2021; Rae et al., 2023). When safety tools are applied in a repetitive and time-pressured manner, they may be perceived as administrative tasks rather than as practical aids for identifying and validating safeguards. This can increase cognitive workload without improving the reliability of defensive controls, particularly in complex operational settings (Hale et al., 2021; Yee & Zolkipli, 2021). In such conditions, SWCs risk functioning as administrative artefacts rather than as mechanisms that support behavioural engagement with safeguards.

Through direct observation of how SWCs are completed in practice, including the timing, depth, and context of their use, this study examines whether SWCs function as active validation tools or as procedural requirements that provide a sense of assurance without confirming functional readiness (Clarke & Waring, 2024; Zolkeply et al., 2025). The literature suggests that when safety tools are decoupled from real work practices, they contribute to latent failures by masking weaknesses in safeguard integrity that remain invisible to management systems (Albrechtsen & Tveiten, 2022; Patriarca et al., 2021; Antonsen et al., 2021; Shorrock, 2021).

3.2.3 Proposition 3: The Supervisor as the Bridge for Functional Integrity

The quality of safeguard validation at the worksite is influenced by the role of the First Line Supervisor (FLS) in facilitating meaningful interaction and dialogue with the workforce. This proposition examines how "show me and tell me" interactions support the development of cognitive ownership of safeguards and provide insight into whether safeguards are understood and applied as functional controls (Albrechtsen & Tveiten, 2022; Roberts & Flin, 2025; Zulkifly et al., 2026). When supervisors actively engage workers through demonstration and explanation, safeguards are more likely to be validated behaviourally rather than assumed to be effective based on documentation alone (Antonsen et al., 2021; Zolkeply et al., 2025). In contrast, supervisory approaches that prioritise schedule adherence or procedural completion may reinforce routine, checklist-based behaviour and discourage the use of Stop Work Authority when safeguards are found to be ineffective (Albrechtsen & Tveiten, 2022; Provan et al., 2021). The "show me and tell me" interaction serves as an observational and diagnostic mechanism to assess whether supervisors function as passive auditors or as active safety coaches (Roberts & Flin, 2025). This proposition supports the examination of how supervisory engagement influences the quality of information exchanged at the point of risk and whether safeguards are merely verified for presence or validated for functional capability (Patriarca et al., 2021; Yee & Zolkipli, 2021; Zulkifly et al., 2026).

3.3 Research Design

This study uses a qualitative case study design to examine how safeguards are applied and verified in real offshore work settings. This design is suitable for exploring work practices and human performance factors within their natural operational context, where behaviour and decision-making cannot be fully understood through surveys or

documentation alone (Yin, 2018; Antonsen et al., 2021; Patriarca et al., 2021). The study focuses on the Tapis field as a bounded operational setting, allowing an in-depth examination of safeguard application during high-risk activities. A non-participant observational approach was used to document actual work practices as they occurred, reducing the influence of self-reporting and socially desirable responses (Bryman, 2016; McCambridge et al., 2014). This approach supports the examination of differences between documented procedures (Work-as-Imagined) and actual work practices (Work-as-Done).

Observation was complemented by a targeted "show me and tell me" interaction to clarify how workers verified the presence and functional readiness of safeguards. This combination of observation and direct clarification provides insight into both visible behaviour and underlying understanding at the point of work (Albrechtsen & Tveiten, 2022; Roberts & Flin, 2025).

3.4 Operational Definition

In this study, operational definitions are used to clarify how key concepts are observed, recorded, and interpreted during fieldwork. These definitions translate theoretical concepts into observable behaviours using the Verification and Validation (VnV) Observation Checklist. By applying consistent operational criteria across the Tapis-D, Tapis-P, and Tapis-E platforms, the study ensures clarity and consistency in examining human performance and safeguard practices.

3.4.1 Verification (Safeguards in Place)

In this qualitative case study, safeguard integrity is understood as requiring both physical presence and functional readiness. Verification is operationally defined as the direct observation of whether life-critical safeguards are physically in place at the

worksite prior to task execution. This includes safeguards such as energy isolations, fire protection systems, and mechanical lifting controls. Verification corresponds to confirmation that the worksite configuration aligns with documented requirements under the Permit-to-Work system and relevant procedures. Evidence of verification is recorded when the researcher observes that the required safeguards are present and correctly positioned before work begins (Albrechtsen & Tveiten, 2022; Antonsen et al., 2021; Zolkeply et al., 2025).

3.4.2 Validation (Safeguards Working on Demand)

Validation is operationally defined as behavioural evidence that a safeguard is capable of functioning when required. Validation is identified through the "show me and tell me" interaction, where the workforce demonstrates and explains the functional readiness of a safeguard. Examples of validation include testing an alarm function, confirming calibration status, or demonstrating the integrity of an energy isolation. Safeguard integrity is considered achieved only when both verification and validation are observed, indicating that the safeguard is not merely present but functionally reliable (Albrechtsen & Tveiten, 2022; Zolkeply et al., 2025; Zulkifly et al., 2026).

3.4.3 Human Performance (HP) Factors

Human performance is operationally defined as the way frontline workers understand, explain, and apply safeguards during task execution. In this study, HP is assessed through observable behaviour and through the quality of explanations provided during the "tell me" component of the VnV interaction. High human performance is recorded when workers demonstrate clear understanding of safeguard purpose, failure modes, and potential consequences of barrier failure. Lower levels of human performance are identified when workers are unable to explain safeguard function, show limited

situational awareness, or fail to recognise early signs of safeguard degradation during high-risk tasks (Endsley, 2021; Patriarca et al., 2021; Roberts & Flin, 2025; Zolkeply et al., 2025; Zulkifly et al., 2026).

3.4.4 Work-as-Imagined (WAI) versus Work-as-Done (WAD)

The distinction between Work-as-Imagined (WAI) and Work-as-Done (WAD) is operationalised by comparing documented procedures with observed work practices. WAI is represented by formal instructions contained in standard operating procedures and safety management documentation, while WAD is captured through field observations and notes recorded during the eight observation sessions. A WAI–WAD gap is recorded when workers adapt, modify, or bypass prescribed steps to manage technical limitations, environmental conditions, or production pressures. These observations provide insight into differences between documented expectations and actual task execution in offshore operations (Antonsen et al., 2021; Hollnagel, 2022; Shorrock, 2021; Zulkifly et al., 2026).

3.4.5 Ritualization of Safety Tools

Ritualisation is operationally defined as the use of safety tools in a manner that prioritises procedural completion over meaningful risk control. Evidence of ritualisation is identified during observation of Start Work Checks (SWC) when checklists are completed without physical inspection of safeguards or when interactions are limited to signatures and verbal confirmation only. Ritualisation is treated as a latent organisational condition that reduces the functional integrity of safeguards. Indicators include rapid checklist completion, limited dialogue, and absence of functional demonstrations. These behaviours are analysed to understand how compliance-focused practices and production pressure influence safeguard verification at the worksite (Clarke & Waring, 2024; Nilsen et al., 2023; Provan et al., 2021; Yee & Zolkipli, 2021).

3.4.6 Start Work Check (SWC) as a Validation Mechanism

The Start Work Check (SWC) is operationally examined as a mechanism that can support safeguard validation rather than as an audit tool. The SWC is assessed based on the extent to which it facilitates meaningful interaction between supervisors and the workforce before high-risk tasks begin. An SWC is considered effective when it prompts workers to demonstrate and explain safeguard functionality through "show me and tell me" interactions. Where SWCs do not lead to such behavioural validation, they are categorised as ritualised activities. This operational definition supports analysis of how SWC practices influence safeguard integrity at the point of risk (Albrechtsen & Tveiten, 2022; Roberts & Flin, 2025; IOGP, 2022; Zolkeply et al., 2025; Zulkifly et al., 2026).

3.5 Measurement of Variables / Instrumentation

This study uses an existing Verification and Validation (VnV) Observation Checklist to guide data collection at the worksite. In offshore operations such as the Tapis field, safety checks are often completed as part of routine compliance activities. However, these checks do not always reflect how safeguards are applied or tested during actual work. The VnV checklist was therefore used to support structured observation of real work practices, focusing on how safeguards are identified, demonstrated, and verified before high-risk tasks begin (Antonsen et al., 2021; Patriarca et al., 2021).

A structured Verification and Validation (VnV) Observation Checklist was developed and utilized. This checklist was developed utilizing the critical components that are vital in helping maintain safeguards in place and work on demand, which will help prevent Life Altering Injury and Fatalities. The word Verification and Validation is to drive behavioural observation as a process of verifying safeguards by observing and validating safeguards by seeking understanding of workers, which ensures Safeguard is in place and works on demand. The checklist documents crucial details such as

general information, including job details. This is followed by workers observation, which specifically focuses on the application and understanding of safeguards, and an in-depth assessment of how safeguards are applied and verified at various stages of Hold Points and Trigger Points. Worker's engagement and observers' reflections are also incorporated to conclude the observation. This study was designed to include approximately 6 to 12 discrete observation sessions covering different tasks and workers within the offshore setting. This range is supported by contemporary methodological guidance which indicates that for studies with narrow research objectives and high "information power," saturation is frequently achieved within this sample size range (Hennink & Kaiser, 2022; Saunders & Townsend, 2024).

The checklist supports observation of the transition between Work-as-Imagined (WAI), as reflected in procedures and permits, and Work-as-Done (WAD), as observed during task execution. It is organised into three main sections, each addressing a different aspect of safeguard use and human performance. This structure allows observations to be recorded consistently across different tasks and platforms within the Tapis-D, Tapis-P, and Tapis-E facilities (Albrechtsen & Tveiten, 2022; Roberts & Flin, 2025; Zolkeply et al., 2025).

3.5.1 Key Concepts

The VnV Observation Checklist focuses on two interrelated phenomena: human performance factors and safeguard understanding. Human performance in this study refers to the behavioural and cognitive elements that influence whether safeguards are effectively applied during work activities. Particular attention is given to how workers demonstrate awareness of risk and understanding of safeguard purpose at the point of work (Patriarca et al., 2021; Shorrock, 2021).

The checklist supports differentiation between verification and validation. Verification relates to confirming that safeguards are physically in place prior to task execution, while validation involves demonstrating that those safeguards are capable of functioning when required. Verification is often limited to confirmation of presence, whereas validation requires active engagement, situational awareness, and technical understanding (Albrechtsen & Tveiten, 2022; Antonsen et al., 2021; Zolkeply et al., 2025). Through the "show me – tell me" interaction, the instrument enables the researcher to capture behavioural evidence of this distinction and to assess the level of cognitive ownership demonstrated by the workforce (Clarke & Waring, 2024; Zulkifly et al., 2026).

3.5.2 Instrument Development and Alignment with Research Questions

The VnV Observation Checklist was developed based on established industry practices, particularly the IOGP Life-Saving Rules and the Start Work Check (SWC) framework (IOGP, 2022; IOGP, 2025a). Its development involved mapping life-critical safeguards against commonly identified human performance challenges reported in the literature, ensuring that the checklist reflected both operational relevance and research objectives (Albrechtsen & Tveiten, 2022; Patriarca et al., 2021). The checklist is aligned with the study's research questions to ensure that data collected directly address the focus of the study. Questions in Section 2 of the checklist capture how workforces define and identify required safeguards, supporting RQ1 and RQ2 (Antonsen et al., 2021; Roberts & Flin, 2025). Questions related to hold points and trigger points provide behavioural evidence of how safeguards are validated during task execution, addressing RQ3 (Albrechtsen & Tveiten, 2022; Zolkeply et al., 2025). The observer reflection section focuses on the quality of interaction and

engagement during the Start Work Check process, allowing assessment of whether safeguard verification remains meaningful or becomes routine and checklist-driven, in line with RQ4 (Clarke & Waring, 2024; Zulkifly et al., 2026). Overall, the VnV Observation Checklist provides a structured yet flexible instrument for capturing qualitative data on safeguard application and human performance, ensuring consistency across observations while allowing insight into real work practices in offshore operations.

i. Section One: General Information and Job Details

Section One records the operational context of each observation. Information documented includes the date of observation, offshore facility location (Tapis-D, Tapis-P, or Tapis-E), and the specific high-risk task being performed, such as energy isolation or breaking containment. These details establish the procedural baseline against which observed practices can be compared, representing the Work-as-Imagined (WAI) for the task (Hollnagel, 2022; Shorrock, 2021). Details of the team or workforce involved are also recorded. This allows subsequent analysis of whether observed behaviours differ across technical disciplines, roles, or levels of experience. Capturing this information provides a basis for examining how procedural intent aligns with, or differs from, actual work practices at the site (Antonsen et al., 2021; Patriarca et al., 2021; Zolkeply et al., 2025).

ii. Section Two: Workforce Engagement (Probes)

It uses a semi-structured set of probes embedded within the observation checklist to engage the workforce through targeted "show me – tell me" interactions. These probes are designed to move beyond administrative confirmation and to elicit behavioural and cognitive evidence of safeguard understanding and use. Questions 1a and 1b focus on

identifying the safeguards in place and the individual responsible for them. These probes assess basic awareness of safeguards and clarity of accountability at the worksite (IOGP, 2022; Albrechtsen & Tveiten, 2022; Roberts & Flin, 2025).

Questions 2a and 2b (Hold Points) examine how Hold Points are identified and who authorises progression beyond them. These questions provide insight into the workforce's recognition of critical stages in the task where validation is required before work can proceed safely (Antonsen et al., 2021; Zolkeply et al., 2025). Question 3a (Trigger Points) explores whether predefined Trigger Points are recognised and understood. This probe assesses situational awareness and the ability to identify operational changes or deviations that require work to stop and be reassessed (Patriarca et al., 2021; Shorrock, 2021; Zulkifly et al., 2026). Questions 4a and 4b (Stop Work Authority) examine the practical use of Stop Work Authority (SWA). These questions assess whether workers feel able to intervene when safeguards are found to be ineffective and whether SWA is applied in practice rather than existing only as a policy requirement (Clarke & Waring, 2024; Provan et al., 2021; Yee & Zolkipli, 2021). Questions 5a and 5b (Feeling Safe) explore the reasons behind the workforce's perception of safety. These probes help distinguish whether confidence is based on demonstrated functional validation of safeguards or on routine and habitual assumptions of safety (Antonsen et al., 2021; Albrechtsen & Tveiten, 2022).

iii. Section Three: Observer's Reflection

This section captures the researcher's reflective assessment of each observed activity. Rather than recording scores or ratings, this section documents the researcher's synthesis of observed actions and workforce explanations gathered during Section Two. The reflection focuses on whether expectations were clearly reinforced at the

worksite and whether any coaching, clarification, or positive reinforcement occurred during the interaction (Roberts & Flin, 2025; Zulkifly et al., 2026). This section is particularly important for identifying instances of ritualised practice. Such instances occur when a safeguard is correctly identified as being present (verification) but the workforce is unable to explain or demonstrate its functional limits (validation). By consolidating these reflections across observations, the study develops a detailed account of how human performance factors influence safeguard integrity in practice (Antonsen et al., 2021; Patriarca et al., 2021; Shorrock, 2021). This approach ensures that data collection goes beyond recording the presence of safeguards and instead captures evidence of functional capability and cognitive ownership (Albrechtsen & Tveiten, 2022; Zolkeply et al., 2025; Zulkifly et al., 2026).

3.5.4 Expert Validation and Pilot Phase

To ensure the content validity and practical relevance of the instrument, a two-stage validation process was carried out. In the first stage, the VnV Observation Checklist was reviewed by three experts: a senior Occupational Safety and Health Management (OSHM) practitioner, a senior Operations practitioner, and an academic. The review focused on the clarity and suitability of the probe questions, particularly their ability to prompt meaningful explanation and demonstration from the offshore workforce (Roberts & Flin, 2025; Zulkifly et al., 2026). In the second stage, a pilot observation was conducted during a routine lifting activity at a simulated worksite with the senior Operations practitioner. This pilot exercise was used to refine the “show me – tell me” interaction and to ensure that the researcher could clearly distinguish between workers repeating procedural requirements and workers demonstrating functional understanding and ownership of safeguards (Albrechtsen & Tveiten, 2022; Antonsen et al., 2021).

3.5.6 Ethical Considerations

All observations were conducted with the knowledge and authorisation of site management and participating teams. Participation is voluntary, and informed consent is obtained prior to data collection. Participants are assured of confidentiality and anonymity, with personal identifiers removed from transcripts and reports. Workers were informed that the purpose of the study was to learn from work as done and to support improvement in safeguards and human performance, rather than to evaluate individual performance. Worker's identities were kept confidential, and behaviours were reported in aggregate without attribution to specific individuals. Observation records were stored securely, and access was restricted to the researcher and supervisory team in line with institutional ethical requirements.

3.6 Data Collection

This study uses a qualitative data collection approach to examine how safeguards are applied and validated during offshore work activities. In high-hazard environments, quantitative indicators often provide limited insight into the behavioural conditions that contribute to safeguard failure. Qualitative data are therefore necessary to understand how safety is managed at the point of work and how workers interpret and apply safeguards in practice (Antonsen et al., 2021; Patriarca et al., 2021; Yin, 2018).

This approach allows the study to move beyond procedural compliance and to explore how and why differences arise between documented safety requirements and actual work execution. By focusing on observed behaviour and direct interaction with the workforce, the study examines how safeguards are understood and enacted under real operational conditions (Shorrock, 2021; Haavik, 2024).

3.6.1 Research Setting: The Tapis Field, Terengganu

Data collection was conducted at the Tapis offshore field, located off the coast of Terengganu, Malaysia. Observations took place at three platforms such Tapis-D, Tapis-P, and Tapis-E during December 2025. These platforms were selected because they represent mature offshore facilities with complex operational demands and ageing infrastructure.

Mature assets are recognised as environments where technical degradation and operational constraints often require greater adaptation during task execution. Such conditions provide a suitable context for examining differences between Work-as-Imagined and Work-as-Done and for observing how human performance influences safeguard application (Albrechtsen & Tveiten, 2022; Reiman et al., 2021; Zolkeply et al., 2025). The environmental and operational conditions typical of offshore operations in Terengganu, including noise, humidity, and time-sensitive activities, further support the examination of safeguard integrity in real work settings (Roberts & Flin, 2025; Zulkifly et al., 2026).

Observations were conducted during routine offshore task execution phases across different work scopes and workers. The offshore setting is characterised by high-risk operations where multiple layers of safeguards rely heavily on effective human performance. The study focused on observing the following target behaviours:

i. Execution phase: Observations recorded how workers members identified and responded to error-prone situations, when and how planned hold points were introduced, and how deviations or trigger points were recognised and managed. Particular attention was given to moments where work was paused or stopped in response to uncertainty or unexpected conditions ("stuck means stop" moments).

ii. Interventions Phase: Observations documented instances where independent verification occurred, especially at unrecoverable task steps or when life-altering risks were present. This included how safeguards were checked, confirmed, or reinforced by supervisors or team members. These target behaviours correspond directly to the key human performance elements related to safeguards, including error recognition, decision-making, communication, and adherence to critical control points.

3.6.2 Type and Sources of Data

This study collected primary qualitative data from multiple sources to support data triangulation. The first source comprised non-participant observations of eight (8) high-risk work activities. The study captured true work behaviours and on-site adaptations that are often absent from standardised and retrospective safety reports. The second source of data involved semi-structured "show me – tell me" interactions conducted at the point of work. These interactions functioned as short, task-focused discussions that complemented direct observation.

They enabled the researcher to link observed actions with the workforce's explanations, providing insight into whether safeguards were only verified as being present or were behaviourally validated as capable of functioning when required. relevant safety documents, including Standard Operating Procedures (SOPs) and Start Work Check (SWC) booklets, were reviewed to establish the Work-as-Imagined (WAI) baseline. This documentation provided the reference point against which observed work practices (Work-as-Done) were compared.

3.6.3 Trustworthiness of the Study

Several steps were taken to enhance the validity and reliability of this qualitative study. Repeated observations across different tasks and workers helped reduce observer bias and increased familiarity with the offshore work context. Behavioural observations were guided by clearly defined human performance elements, including error-prone situations, safeguards, hold points, and trigger points, to support consistency in interpretation. The use of a structured V&V observation checklist ensured that observations were recorded in a consistent manner and that critical elements were systematically captured across all observation sessions. Triangulation across different execution phases, different workers, and different work scopes was intentionally applied to validate recurring patterns, minimise single-situation bias, and enhance the overall trustworthiness of the findings.

This study addresses the following criteria to ensure the trustworthiness of the qualitative findings are

i. Credibility: Achieved through prolonged engagement with participants and clarification of responses during interviews.
ii. Dependability: Ensured by maintaining a clear audit trail of research procedures and analytical decisions.
iii. Confirmability: Supported by reflexive notes to minimise researcher bias.
iv. Transferability: Enhanced through rich descriptions of the study context and participants

3.6.4 Data Collection Execution

Data collection in this study focused on selected high-risk and high-consequence work activities, including breaking containment, energy isolation, hot work, and mechanical lifting. These activities were chosen because failure of even a single safeguard during their execution can result in severe or life-altering outcomes (Albrechtsen & Tveiten, 2022; Zolkeply et al., 2025). Concentrating on such tasks ensured that the data collected were directly relevant to the research objectives and reflected situations where safeguard integrity is most critical. This focused approach supports the principle of information power in qualitative research. Information power is achieved when the specificity of the data and the quality of interaction between the researcher and the workforce provide sufficient depth to address the research questions, without the need for extensive or repetitive sampling.

3.7 Sampling

This study uses a purposive sampling strategy to select participants who are able to provide relevant and meaningful insight into the application and verification of safeguards in offshore operations. In qualitative research, purposive sampling is appropriate when the aim is to explore specific work practices and behaviours rather than to achieve statistical representation (Antonsen et al., 2021; Saunders & Townsend, 2024). The sampling approach focuses on frontline offshore personnel who are directly involved in high-risk, safety-critical activities. This ensures that the data collected reflect the realities of Work-as-Done (WAD) and address the gap between procedural intent and actual work practices observed at the worksite3.7.1 Inclusion Criteria and Participant Characteristics

3.7.1 Participant Selection and Inclusion Criteria

Participants were selected based on their direct involvement in offshore operational activities and their exposure to life-critical safeguards. To ensure relevance and depth of insight, the following inclusion criteria were applied: Minimum experience in offshore operations, ensuring familiarity with operational procedures and safeguard systems. Direct exposure to operational safeguards, such as energy isolation, breaking containment, hot work controls, and mechanical lifting systems. Active involvement in safety-critical tasks performed at the worksite. The sample included personnel from a range of operational roles, including production operators, mechanical technicians, rigging and lifting specialists, construction workers, and First Line Supervisors (FLS). Including participants from different technical disciplines and levels of seniority allowed the study to capture variation in how safeguards are understood, applied, and validated across the workforce.

3.7.2 Sample Size

In qualitative research, adequacy of sample size is commonly determined by the principle of data saturation rather than by statistical power calculations. Saturation is reached when additional cases no longer yield new themes or insights relevant to the research questions, indicating that the data are sufficiently rich to address the study objectives. Guest, Bunce, and Johnson (2006) provide empirical guidance for observation based qualitative research, demonstrating that data saturation can often be achieved with a relatively small number of focused, information rich cases. Therefore, this qualitative research will focus on acquiring 6 to 12 discrete observations to conclude the study.

3.8. Data Collection Procedures

The data collection was executed through a systematic five-stage protocol designed to maintain professional caution and academic rigor while minimizing operational disruption in the high-hazard offshore environment. This qualitative fieldwork prioritized the capturing of authentic "**Work-as-Done**" (WAD) patterns, moving beyond the superficiality of administrative audits (Antonsen et al., 2021; Shorrock, 2021; Zolkeply et al., 2025).

3.8.1 Organizational Authorization

Before commencement a formal organizational permission was secured from the asset management team and offshore leadership for the Tapis field facilities. This phase involved site-specific safety orientations and the establishment of a "no-harm" protocol (Creswell & Poth, 2024; Bryman, 2021). This protocol was essential to ensure that the researcher's presence as an observer did not distract the workforce during critical phases of work, thereby maintaining ethical standards and operational safety (McCambridge et al., 2023; Flick, 2023). By establishing clear boundaries, the researcher mitigated potential safety risks while ensuring the integrity of the naturalistic setting (Antonsen et al., 2021; Yin, 2024).

3.8.2 Gaining Access to Site and Participants

Access to the research setting platforms Tapis-D, Tapis-P, and Tapis-E was facilitated through coordination with the platform offshore leadership. Participants were accessed at the "sharp end" of operations during the pre-task phase of high-risk activities. To minimize the Hawthorne Effect and ensure authentic data, the researcher's role was clearly communicated as a scholarly inquiry rather than a compliance audit (Bieder, 2022; Hale et al., 2021). Participation was voluntary, and verbal consent was re-

confirmed at the worksite before the commencement of each observation session to ensure participants felt psychologically safe to share adaptive practices (Patriarca et al., 2021; Yee & Zolkipli, 2021; Zulkifly et al., 2026).

3.8.3 Point-of-Risk Observation (The Pre-Task Phase)

The researcher positioned themselves as a non-participant observer during the pre-task phase, specifically during the Toolbox Talk (TBT) and the completion of the Start Work Check (SWC). This allowed for the documentation of the team's natural communication and the degree of ritualization during the checklist process (Antonsen et al., 2021; Patriarca et al., 2021; Shorrock, 2021). This stage focused on identifying whether the workforce was merely performing administrative verification (ticking boxes) or engaging in a meaningful critical dialogue regarding safeguard readiness (Albrechtsen & Tveiten, 2022; Roberts & Flin, 2025).

3.8.4 VnV Interaction (The Interview Process)

Upon completion of the pre-task rituals, the researcher administered the semi-structured "Show me – Tell me" probes. These interactions occurred directly at the worksite to maintain contextual relevance and typically lasted 10 to 15 minutes to avoid disrupting production schedules. Due to the hazardous nature of the Ex-Zone (Explosive Atmosphere) on offshore platforms, digital audio recording was prohibited. Consequently, data were captured via real-time shorthand notes on the VnV Observation Checklist (Albrechtsen & Tveiten, 2022; Roberts & Flin, 2025). For example, if a workforce verified a gas detector was "in place," the researcher asked, "*Can you show me the detector's alarm test results and tell me the set-point for this hydrocarbon?*" This probe effectively tested whether the workforce understood the

functional capability of the safeguard or was merely performing a symbolic ritual of compliance (Antonsen et al., 2021; Zolkeply et al., 2025; Zulkifly et al., 2026).

3.8.5 Field Note Documentation and Reflexivity

Immediate post-observation field notes were recorded to capture a "thick description" of the event. These notes documented non-verbal cues, the leadership style of the First Line Supervisor (FLS), and environmental pressures such as heat, noise, and time constraints (Patriarca et al., 2021; Guest et al., 2021). The researcher practiced reflexivity by acknowledging their own professional background in OSHM, ensuring that personal biases did not colour the interpretation of adaptive behaviours (Nowell et al., 2024; Thorne, 2022). These contextual details are vital for understanding the drivers of behavioural variability and the erosion of safety margins in aging facilities (Haavik, 2024; Zulkifly et al., 2026).

3.9 Techniques of Data Analysis

The analytical framework for this study utilizes a Qualitative Analysis approach, facilitating a comprehensive and side-by-side comparison of behavioural patterns across the eight observational sessions. This technique is specifically designed to manage high volumes of qualitative data comprising field notes, checklist responses, and observer reflections while ensuring the analysis remains strictly grounded in the research questions (Miles et al., 2022; Nowell et al., 2024; Yin, 2024). In the context of the Tapis field, meaning was derived by identifying the recurring discrepancies between the organizational "imagination" of safety and the adaptive, behavioural reality of "Work-as-Done" (Antonsen et al., 2021; Shorrock, 2021; Zulkifly et al., 2026).

3.9.1 Data Preparation and Transcription Process

Because digital audio recording was restricted due to offshore Ex-Zone (Explosive Atmosphere) safety protocols, the transcription process involved the immediate systematic digitization of shorthand field notes and the handwritten Verification and Validation (VnV) Observation Checklists. This "post-session expansion" was conducted within 24 hours of each observation to ensure the preservation of contextual nuances and non-verbal cues (Flick, 2023; Saunders & Townsend, 2024). The raw data were transcribed into a structured Qualitative Analysis Matrix, where each task (e.g., energy isolation, hot work) was catalogued alongside the corresponding "Show me – Tell me" responses. This meticulous preparation ensures that the subsequent coding process is based on a high-fidelity representation of the field reality (Nowell et al., 2024; Roberts & Flin, 2025).

3.9.2 Thematic Analysis and Iterative Coding

The primary analytical approach employed was Thematic Analysis, following the six-phase reflexive framework to identify, analyse, and report patterns of meaning (Braun & Clarke, 2023; Nowell et al., 2024). During the Iterative Coding phase, the researcher utilized "in vivo" codes to capture the specific technical vernacular used by the Tapis offshore workforces. These codes were categorized into themes related to Verification (safeguards in place), Validation (safeguards working on demand), and Ritualization (tick-box mentality) (Antonsen et al., 2021; Patriarca et al., 2021; Saldaña, 2021). This process allowed for the identification of "behavioural holes" in the safeguard system moments where the workforce could recite a procedure but could not functionally demonstrate the barrier's readiness (Albrechtsen & Tveiten, 2022; Zolkeply et al., 2025; Zulkifly et al., 2026).

3.9.3 Pattern Matching: WAI vs. WAD

A critical component of deriving meaning from the data was Pattern Matching. The researcher systematically contrasted the observed field reality (Work-as-Done) with the documented safety protocols and SOPs (Work-as-Imagined) (Hollnagel, 2022; Shorrock, 2021). This comparison highlighted the systemic gaps and "observational voids" where administrative compliance was successfully achieved on paper, yet functional validation was neglected at the point of risk (Antonsen et al., 2021; Thorne, 2022; Zolkeply et al., 2025). By matching these patterns across different platforms (Tapis-D, P, and E), the study identifies whether certain disciplines such as mechanical lifting or breaking containment are more susceptible to the ritualization of safety tools (Roberts & Flin, 2025; Zulkifly et al., 2026).

3.10 Summary of Chapter

This chapter has outlined the qualitative non-participant observational methodology used in the study, including the setting, target behaviours, data collection procedures, and analysis approach. By using the VnV Observation Checklist in combination with field notes and behavioural mapping, the study systematically captured how offshore workers recognise and manage error-prone situations, apply safeguards, hold points, and trigger points during execution.

CHAPTER 4

RESULTS AND DISCUSSION

This chapter presents the findings from the qualitative, non-participant observations conducted at the Tapis offshore field using the Verification and Validation (VnV) Observation Checklist. The analysis examines differences between documented safety expectations (Work-as-Imagined) and actual work practices observed at the frontline (Work-as-Done). The findings are organised in line with the research objectives and focus on human performance factors that influence how safeguards are applied and verified during offshore work activities. Particular attention is given to the use of Hold Points, Trigger Points, and Start Work Checks (SWC) as observed in practice.

4.1 Participant Profile and Operational Context

The observations were conducted in December 2025 at the Tapis offshore facilities, specifically Tapis-D, Tapis-P, and Tapis-E. The observed workforce included mechanical technicians, HVAC specialists, rigging and lifting personnel, heavy maintenance teams, and catering staff. Offshore experience among the workforce ranged from early-career personnel with approximately two to five years of experience to highly experienced workers with more than fifteen years offshore. The work activities took place across a variety of operational areas, including production support zones, life support and maintenance areas, pressurised habitats, cellars, living quarters, galley spaces, and open decks where lifting and overboard activities were carried out. These settings represent typical offshore environments where safeguards are required to be applied consistently under varying operational and environmental conditions.

The workforce comprised mainly trade-skilled personnel supported by supervisory roles. Formal qualifications ranged from technical and vocational certificates to supervisory-level credentials, reflecting the standard workforce profile in offshore oil and gas operations. Many workers held task-specific competencies, including Permit to Work (PTW) authorisation or familiarity, designated fire watcher roles for hot work, certified food handler status for galley operations, and rigging and lifting certifications. These competencies indicate a baseline level of technical knowledge and procedural familiarity in executing assigned tasks. First Line Supervisors (FLS), foremen, area authorities, and camp bosses were present during different observation sessions. These roles were responsible for overseeing work activities, authorising permits, and, in principle, verifying safeguards and Hold Points prior to task execution (Roberts & Flin, 2025; Zolkeply et al., 2025).

To ensure consistency in data capture, the Verification and Validation (VnV) Observation Checklist was used for each observation session. The checklist recorded general job details, workforce engagement with safeguards, supervisory interaction, and any recognition or feedback provided. This structure enabled the researcher to document not only what the workforce stated about safeguards, Hold Points, and Trigger Points, but also how they behaved when faced with error-prone situations and potential stop-work decisions. The range of roles, experience levels, and core responsibilities observed during the study is summarised in Table 4.1, which illustrates the diversity of functions involved in the application of safeguards in offshore operations.

Table 4.1

Summary Of Observed Offshore Roles, Experience and Responsibilities

No	Role Category	Years of Offshore Experience	Main Responsibilities	Offshore Related Competencies
1	Mechanical technicians	5–15 years	Equipment maintenance (e.g., ME217 Brucker), isolation, testing	Basic/Global Maintenance Practices (Mechanical) certificate or diploma; BOSIET/FOET offshore safety training; Control of Work / Permit to Work (PTW) awareness or Performing Authority training as per company matrix.
2	HVAC specialists	5–10 years	AHU troubleshooting, rectification and functional checks	Relevant OPITO maintenance/technical competence where applicable; BOSIET/FOET; Control of Work / Permit to Work (PTW) awareness; safe electrical/mechanical isolation modules in line with company and OPITO aligned competence frameworks.
3	Heavy maintenance workforces	5–20 years	Painting, abseiling, working at height and overboard	Working at height / rope access competence per industry standards; BOSIET/FOET; dropped objects and manual handling awareness; other task specific safety training as defined in the operator's OPITO aligned competence matrix.

4	Rigging/lifting workforce	3–15 years	Lifting operations, line of fire control, use of lifting gear	OPITO Rigger Initial Training and Rigger Competence Assessment; where applicable, Offshore Crane Operator (OCO) Stage 3 competence; BOSIET/FOET; lifting operations and line of fire awareness training.
5	Catering staff	2–10 years	Galley operations, food preparation, maintaining hygienic conditions	BOSIET/FOET offshore safety training; recognised food handler / food hygiene certification; galley safety and basic HSE modules following OPITO aligned offshore safety requirements.
6	Supervisors/foreman/FLS	10+ years	Work planning, Permit to Work (PTW), verification of safeguards and coaching	Control of Work / Permit to Work (Performing Authority) OPITO approved training; BOSIET/FOET; supervisory HSE / safety leadership training as defined by company and OPITO aligned standards.

4.2 Analysis of Observation Context

The qualitative data gathered through the Verification and Validation (VnV) Observation Checklist highlights a recurring conceptual gap. The matrix below synthesizes the eight discrete sessions, contrasting technical verification with functional validation behaviours.

Table 4.2
Qualitative Analysis Matrix of Safeguard Understanding

Obs Ref	Task Observed	Hold Point Understanding	Response to Trigger Points	Safeguard Application
VnV-01	ME217 Brucker Maintenance	Low. Failed to define "unrecoverable step" (before entering Brucker).	Inaccurate. Linked to weather/alarms rather than specific SWC Trigger Points.	Poor. Awareness was generic; failed to identify Maintenance Pendent as critical.
VnV-02	Hot Work (Pressurized Habitat)	Low. Knew existence but could not define the concept (before entering habitat).	Partial. Responded to sensory alarms only; failed to mention notifying supervisors.	Moderate. Understood basic habitat function but could not articulate "why" or "how".
VnV-03	AHU Troubleshooting	Moderate. Linked to PTW; failed to identify Hold Point as prior to "crack open" phase.	Good. Identified hissing/sparks but struggled to articulate precise actions or SWC links.	Moderate. Identified electrical isolation (LOTO) but unable to articulate "why".
VnV-04	Galley Operations	None. No understanding of the term or concept.	Low. Treated slips/burns as routine rather than SWC Trigger Points.	None. Equated safety only with PPE; zero understanding of "safeguards" term.

VnV-05	Painting (Abseiling)	Moderate. Aware of SWC but could not point out Hold Point (before operating airline).	Good. Actively identified anchor points deviations as a Stop Work situation.	Moderate. Referred to SWC for Line of Fire; understood barricades/whip checks.
VnV-06	Routine Lifting	Moderate. Relied on supervisor cues; missed Hold Point (before climbing crane ladder).	Good. Recognized line-of-fire risks; noted weather and equipment failure.	Moderate. Maintained exclusion zones but could not articulate "why".
VnV-07	Breaking Containment	Moderate. Knew Hold Point should be predetermined before Breaking Containment.	Partial. Identified air gushing but used vague answers when referring to SWC.	Good. Articulated "line of fire" risks well; confirmed LOTO and Zero Energy.
VnV-08	Energy Isolation (QC)	Moderate. Failed to identify Hold Point as prior to pumping pressure.	Good. Responded correctly to LEL gas readings and proximity to leaks.	Good. Confirmed isolation via gas detector but understanding was narrow.

Key thematic observations from the matrix capture a broad range of safeguards by exercising the effectiveness in the application of Hold Point and Trigger Points. These include the Conceptual Gap (struggling with unrecoverable steps), Sensory vs. Logical Triggers (responding to alarms but not environmental deviations), and the Role of the SWC (more articulate application when explicitly used). These settings provided a rich basis for examining how safeguards are applied in real-time.

i. The Conceptual Gap: A recurring pattern across VnV-01, VnV-02, and VnV-04 shows that while workforces are familiar with tasks, they struggle to define "unrecoverable steps" or formal "Hold Point".

ii. Sensory vs. Logical Triggers: Workforces respond well to physical alarms (VnV-02, VnV-08) but often fail to recognize environmental or subtle procedural deviations as formal triggers to stop work.

iii. Role of the SWC: In tasks where the Start Work Check was explicitly utilized (VnV-05, VnV-06), safeguard application was significantly more articulate than in routine areas like galley operations.

These observation settings provided a rich basis for examining how safeguards, Hold Point, Trigger Points and Start Work Check (SWC)s are understood and applied in real time offshore operations.

4.3 Theme 1: Error-Prone Situations in Offshore Operations and Risk Normalization

The study identified that error-prone situations are shaped by conceptual gaps and the normalization of operational constraints. In task VnV-01, the workforce failed to recognize that entry into the Brucker was an "unrecoverable step". This aligns with the discussion in safety science where repeated exposure to hazardous conditions leads to desensitization. A recurring sense of “feeling safe” (VnV-01, VnV-02, VnV-06) emerged even though participants were operating in high-hazard environments. This suggests a safety culture shaped by everyday experience, where workers make sense of risk through what feels familiar and manageable rather than through an accumulation of potential hazards. Consistent with the idea of Embodied Bounded Rationality (Gallese et al., 2021), decision-making appears to be guided by a

simplified understanding of the work environment. As hazardous conditions become routine and taken for granted, workers are less inclined to question weakened safeguards, allowing underlying weaknesses to remain unnoticed and persist across multiple layers of defence, as reflected in the Swiss Cheese Model.4.3.1 Observed error-prone situations.

Workforces frequently encountered tasks and conditions in which potential for error and harm was elevated due to task complexity, environmental constraints or organisational pressures. Examples included maintenance inside the ME217 Brucker, hot work conducted within pressurized habitat s, lifting operations in congested deck areas, overboard and working at height activities, as well as routine galley work in confined, sometimes slippery spaces.

In the ME217 Brucker maintenance task, certain unrecoverable steps meant that errors beyond entry into the equipment could result in serious and difficult-to-reverse consequences. However, the workforce did not clearly recognise this stage as a critical Hold Point. Similarly, hot work within pressurized habitat s involved fire and explosion risks in the event of pressurized habitat pressure or gas detection failure, lifting and overboard work exposed workforces to line of fire and dropped object risks, particularly under changing weather and sea conditions. Although, galley operations, were often perceived as routine, in combination of limited space, hot surfaces and slip hazards, created conditions in which minor deviations could escalate into incidents.

These situations reflected the interaction of human, technical and environmental factors Human factors included incomplete understanding of safeguards, occasional complacency, reliance on habit and varying levels of situational awareness, while technical factors related to equipment condition, alarms, gas detectors, harness and

anchor points and the design of pressurized habitat s and lifting gear. Environmental factors encompassed weather, sea state, lighting, congestion and workspace layout, all of which influenced the likelihood of error and the effectiveness of safeguards.

4.3.2 Workforce's perceptions of risk and hazard

Workforce's perceptions of risk and hazard did not always align with the objective risk level implied by the task and environment. Many workforces reported feeling safe and expressed "no concern" even when operating in constrained, slippery or high hazard conditions, suggesting that some risks had become normalised as part of everyday work. For instance, the galley workforce recognised that the workspace was limited and sometimes slippery, with several people working close together, yet he framed these conditions as routine and manageable rather than as indicators of an error-prone situation requiring structural controls.

In lifting and overboard operations, workforces acknowledged the challenges of working in congested deck areas with simultaneous operations and exposure to height but often described these as standard features of offshore work rather than triggers for heightened caution or additional safeguards. Workforces also tended to emphasise their own experience and familiarity with tasks as reasons for feeling safe, even when they had limited conceptual understanding of safeguards or when procedures such as Hold Point and Trigger Points were only loosely understood.

These perceptions are consistent with literature on high-risk work, which suggests that repeated exposure to hazardous conditions can lead to desensitisation and underestimation of risk. When workforces view hazardous conditions as "normal," they may be less inclined to question existing safeguards or call for changes to layout, equipment or procedures, thereby perpetuating error-prone situations.

4.3.3 Illustrative Examples from Observations

The observation records provide several illustrative examples of how error-prone situations emerged in practice. In the ME217 Brucker maintenance task, the workforce "struggled to clearly identify are safeguards" and only referred generally to Permit To Work, Job Safet Analysis or procedures, without specifying concrete safeguards or how to find quickly during operations. This indicates that even in critical tasks, safeguard awareness may remain unclear and generic references rather than ask specific.

In the hot work in pressurized habitat observation, a workforce described an occasion in which a pressurized habitat pressure alarm activated, he went on to stop the work while pressure loss was identified and rectified. However, the supervisor was only informed later rather than immediately at the point of deviation, highlighting a gap between recognising an error-prone situation and formal escalation.

In the galley, the workforce demonstrated "zero understanding on safeguards" and equated safety almost entirely with PPE, despite acknowledging limited space and potential for slips. During working at height activities, one workforce intervened to correct a scaffolder's anchor point that had dropped below hip level, insisting that it be repositioned above the head and away from sharp edges before work continued. This example shows that individuals can sometimes intuitively recognise and correct unsafe conditions, even in the absence of fully articulated concepts of safeguards and Hold Point.

Collectively, these examples show that error-prone situations in the offshore context are not only about hazardous tasks and environments but also about how those hazards are perceived, conceptualised and embedded in everyday practices.

The observational data confirm that human performance factors knowledge, motivation, engagement, and behaviour significantly affect how offshore workforces identify hazards and interpret safeguards. Training and competency were visible, but conceptual gaps showed that competence remained partial. For example, workforces naming specific measures (pressurized habitat, gas detector) struggled to explain why they were necessary, suggesting training may have emphasised procedural compliance over a deeper understanding of human error mechanisms. Experience and knowledge influenced risk perception; while more experienced workforces recognised "weak signals," experience also contributed to the normalisation of risk. This aligns with studies showing that habitual exposure can reduce perceived hazards, leading to the acceptance of sub-optimal conditions as routine. Furthermore, workforces often reported feeling safe even in high-hazard conditions, suggesting risks had become normalised part of everyday work.

Table 4.3
Summary of Error Prone Situations in Offshore Operations

Sub Theme	Error-Prone Condition Observed	Contributing Factors
ME217 Brucker maintenance	Unrecognised unrecoverable step	Conceptual gap in safeguards, task familiarity
Hot work in pressurized habitat	Delayed escalation after deviation	Weak trigger-point application, reliance on alarms
Lifting & overboard work	Line-of-fire and dropped-object exposure	Congestion, weather, normalisation of risk
Galley operations	Slips and burns treated as routine	Habit-based risk perception, PPE-focused safety

4.4 Theme 2: Effectiveness of Hold Point and Trigger Points

The findings indicate considerable variability in how Hold Points and Trigger Points are applied. While workforces identified sensory triggers like "hissing sounds" or "sparks" (VnV-03, VnV-08), they struggled to define the formal concept of a Hold Point as an intervention prior to an unrecoverable step.

This lack of precision reduces the effectiveness of safeguards. If the workforce cannot identify the exact task stage requiring independent verification, they effectively create a "behavioural hole" in the defensive layers. Positive interventions (VnV-05) where anchor points were repositioned reflect hallmarks of High Reliability Organization (HRO) principles, such as sensitivity to operations.

4.4.1 Understanding and use of Hold Point

When asked how Hold Point check were determined, workforces commonly referred to Job Safety Analysis, Permit to Work (PTW), Life Saving Actions (LSA) or procedures, rather than providing clear or actual definitions, which meets the intent. In the ME217 Brucker maintenance observation, the workforce acknowledged that Hold Point should be established for critical work and could be identified in Job Safety Analysis documentation. However, he was unable to clearly articulate what constituted a Hold Point or to identify the specific unrecoverable step at which a Hold Point check should be applied.

From a human performance perspective, the appropriate Hold Point in this task would be prior to entering the Brucker, as errors beyond this step could result in serious and difficult to reverse consequences. The absence of explicit recognition of this unrecoverable step reduced the effectiveness of the Hold Point as a deliberate decision

checkpoint. Similar patterns were observed for hot work in pressurized habitat s. Workforces mentioned that Hold Point were “in Job Safet Analysis, Permit to Work (PTW), Life Saving Action and procedure” and that critical work required such checks, but when asked what Hold Point is, they could not provide a clear explanation. In this context, the appropriate Hold Point would typically be set before entering the pressurized habitat or before initiating hot work inside the enclosure where fire and explosion risks are significant. In working at height observations, workforce understood that there needed to be checks before climbing, yet they did not consistently use the language of Hold Point nor explicitly link these checks to the concept of an unrecoverable step. Instead, they described general practices such as “checking harness” or “checking anchor point” without situating these checks within a formal Hold Point framework.

This lack of preciseness or lack of understanding reduces the effectiveness of Hold Point as a checkpoint to inspect if safeguards are in place and safeguards work on demand. If workforces cannot clearly identify the task stages at which work must pause for independent verification, there is a risk that crucial checks could miss the strength of safeguards to prevent Life Altering Injuries and Fatalities, which will undermine their original intent.

4.4.2 Trigger Points in practice

Trigger Points predefined as deviations or changing conditions that should prompt reassessment or stop work were somewhat more tangible for workforces because they often correspond to visible or audible triggers. Across different tasks, workforces mentioned triggers such as, weather changes and rough sea conditions when working overboard or lifting with vessel alongside, equipment alarms, including pressurized

habitat panel alarms indicating pressure loss, hissing sounds after what was believed to be complete isolation, or sparks during cable removal and workforce tripping in the Brucker or moving into unsafe zones during lifting operations.

In certain cases, workforces responded effectively. A notable example involved a workforce who recognised that a scaffolder's anchor point was found to be below hip level and instructed him to reposition it above the head before continuing work will prevent a potential serious fall from height, which can still lead to Fatality and life Altering Injury due to Suspension Trauma. Another example concerned a workforce who stopped a colleague from approaching a leak segment and insisted on maintaining distance until the leak was properly managed, explicitly describing the situation in terms of line of fire.

However, these actions were typically described as individual judgements rather than as execution of clearly defined Trigger Point protocols. Workforces did not consistently relate these triggers back to Start Work Check items or Life Saving Rules, nor did they always escalate to supervisors immediately. When Trigger Point missed and a pause or stop of work does not take place while workforces normalize the risk and continue, this will lead to potential Fatality and Life Altering Injury. In the hot work pressurized habitat observation, the workforce only informed the foreman about the pressure loss incident when he encountered him later, not immediately after the alarm occurred.

The data therefore suggest that although workforces can detect deviations, there is a gap between recognition and structured action consistent with the Trigger Points concept described in the literature and organisational guidance. This gap limits the

value of Trigger Points as a formal safeguard, as many actions remain ad hoc rather than systematically linked to stop work authority and formal reassessment steps.

4.4.3 Effectiveness and challenges

The observations highlight that Hold Point and Trigger Points exist in policy and to some extent in practice, but their effectiveness is constrained by inconsistent application and unclear role allocation. Workforces' descriptions indicated that Hold Point were often seen as generic procedural requirements rather than as carefully pauses or halt application at unrecoverable steps to verify and validate safeguards being in place and work on demand. While Trigger Points were largely interpreted through experience and sensory triggers without always being tied to formal stop work criteria. These concerns represent latent conditions in the sense of the Swiss Cheese Model, as they create structural vulnerabilities that may align with other weaknesses under pressure. When combined with factors such as time pressure, production demands and variable training, these weaknesses increase the likelihood that hazardous situations will progress without adequate verification or intervention.

This summary highlights that while Hold Point and Trigger Points were present in practice, their effectiveness was limited by inconsistent conceptualisation and application, reducing their reliability as formal safeguards.

Safeguards in this study were conceptualized as multi-layered defences (technical, managerial, behavioural), aligning with the Swiss Cheese Model. Hold Point and Trigger Points were the least understood mechanisms. The lack of a shared definition for "unrecoverable steps" means the "holes" in the slices often align, allowing hazards to propagate. Positive examples like strict LEL threshold adherence demonstrate that tying safeguards to tangible, life-saving rules makes them more internalised.

Table 4.4
Summary of Effectiveness of Hold Point and Trigger Points

Safeguard Element	Observed Practice	Key Limitation Identified	Implication for Safe Work
Hold Point	Referenced in Job Safety Analysis, Permit to Work (PTW), Life Saving Action, and procedures	Lack of clear definition and identification of unrecoverable steps	Critical verification checks may be rushed, misplaced, or omitted
Hold Point	Informal pre-task checks (e.g. harness or anchor checks)	Not explicitly framed as Hold Point	Reduced effectiveness as deliberate decision checkpoints
Trigger Points	Recognised through alarms, weather changes, or visible deviations	Actions driven by individual judgement rather than formal criteria	Inconsistent stop works and escalation practices
Trigger Points	Corrective actions taken at task level	Weak linkage to Start Work Check (Start Work Check (SWC)) and Life Saving Rules	Ad hoc responses rather than systematic safeguard activation

The literature review highlighted that human performance in high-risk environments is shaped by cognitive, behavioural and organisational factors such as training, competency, situational awareness, communication and leadership. The observational data from this study confirm that these factors significantly affect how offshore workforces identify hazards, interpret safeguards and decide when to stop work or escalate concerns,

thereby influencing safety outcomes. This chapter interprets these findings in relation to the theoretical and conceptual framework, drawing implications for offshore safety practice and future research.

Training and competency were visible in workforces' ability to describe certain safeguards and identify some error-prone situations, but conceptual gaps showed that competence remained partial. For example, workforces involved in ME217 Brucker maintenance, hot work in pressurized habitat s and AHU troubleshooting could name specific protective measures (pressurized habitat, gas detector, electrical isolation) yet struggled to explain why these were necessary or how they related to Start Work Check (SWC) and Life Saving Rules. This suggests that training may have emphasised procedural compliance more than deeper understanding of human error mechanisms, consistent with prior research that warns against overly proceduralised approaches that neglect behavioural skills.

Experience and knowledge influenced risk perception and decision making. More experienced workforces were often able to recognise weak signals such as unusual sounds, alarms or changes in equipment behaviour and in some cases acted appropriately by stopping work or correcting unsafe conditions. However, experience also appeared to contribute to normalisation of risk, particularly when workforces described constrained spaces, slippery floors or complex lifting conditions as normal aspects of the job and reported feeling "safe" despite observable vulnerabilities. This aligns with studies showing that habitual exposure to risk can reduce perceived hazard and lead to acceptance of sub optimal conditions as routine.

Communication and coordination played a central role in shaping how safeguards were applied. Where supervisors engaged proactively in coaching explaining Start

Work Check (SWC) meaning, reinforcing expectations and providing immediate feedback workforces displayed stronger understanding and more consistent safety behaviours. Conversely, where communication about safeguards was limited or delayed, such as in the case where a workforce only informed the supervisor about a pressurized habitat pressure loss incident later rather than at the time, opportunities for timely verification and organisational learning were reduced. These patterns support the view that effective communication mechanisms are essential for translating safety systems into real world actions in high-risk settings.

Overall, the findings demonstrate that human performance factors are not abstract constructs but observable influences on day-to-day decisions at the worksite, reinforcing the argument that strengthening these factors is essential to bridging the gap between policy and practice.

4.5 Theme 3: Implementation and outcomes of Start Work Check (SWC)

The study confirms that SWC resources are present but often underutilized as a behavioural tool. While supervisors provide coaching to bridge this gap (VnV-01, VnV-02), the tool is frequently treated as an administrative requirement rather than an empowering conversation. This "ritualization" leads to a decoupling where the physical act of ticking a box is separated from actual risk mitigation. Clarke and Waring (2024) argue that this mentality masks latent failures from management. Conversely, the 11% reduction in TRIR at Chevron North Sea proves that when SWCs move from rituals to critical dialogues, they become life-saving interventions.

4.5.1 Implementation of Start Work Check

Across all major task categories observed, Start Work Check (SWC) resources were available at the worksite level, particularly for high-risk activities aligned with Life Saving Actions. These activities included working at height and overboard, energy isolation, breaking containment, hot work, lifting and line of fire operations. When workforces were asked where they could quickly refer to safeguards relevant to their tasks, several identified Start Work Check (SWC) as a reference point, although this recognition often emerged only after probing.

Based on the observations, awareness of Start Work Check (SWC) among workforces could be broadly categorized into three informal levels. At the lowest level, some workforces demonstrated minimal or no prior exposure to Start Work Check (SWC) concepts. This was illustrated by a galley workforce who reported having "never heard the word safeguards before" and who equated safety almost entirely with the use of personal protective equipment. At moderate level, workforces recognised that safeguards could be found in Permit to Work (PTW), Job Safety Analysis and procedures and occasionally referred to Start Work Check (Start Work Check (SWC)) as a source of information. However, they were generally unable to identify specific safeguards or explain their purpose. This level of awareness was observed among some ME217 Brucker maintenance and AHU troubleshooting workforce. At a higher level, workforces identified that Start Work Check (SWC) and IOGP Life Saving Rules as primary sources of safeguards, particularly for working at height and overboard activities, although they still had trouble articulating the full set of applicable safeguards.

In many observations, supervisors provided step-by-step coaching to explain what Start Work Check (SWC) is and why it is important for preventing serious harm or fatalities. This coaching typically involved linking Start Work Check (SWC) items directly to task-specific conditions and risks. These interactions suggest that while awareness of Start Work Check (SWC) exists, it has not yet been fully internalised as a self-initiated and routinely applied tool among all frontline workforces.

4.5.2 Outcomes of Start Work Check

Despite these challenges, Start Work Check (SWC) concepts appeared to influence some positive safety behaviours in the field, especially when reinforced by supervisors. For energy isolation and breaking containment tasks, workforces used gas detectors to monitor flammable atmospheres and understood that certain lower explosive limit (LEL) readings required them to stop work and report to the control room before proceeding, in line with Start Work Check (SWC) expectations.

In line of fire and lifting operations, some workforces actively maintained exclusion zones and intervened when others entered unsafe areas or attempted to remove LOTO devices prematurely, demonstrating ownership of key Start Work Check (SWC) principles. For example, one observation recorded that a workforce stopped another person from approaching a leak segment and emphasised the potential for serious harm from the line of fire, reflecting awareness consistent with Life Saving Rules.

These examples mirror case evidence reported in external literature, where Start Work Check (SWC) implementation has been associated with reductions in incident rates and improved hazard recognition and stop work behaviours. While the present study did not measure outcomes quantitatively, the qualitative data show that Start Work

Check (SWC) related thinking, particularly when coupled with coaching, can support more consistent identification and control of serious risks.

4.5.3 Challenges in Embedding Start Work Check

The observations also highlight several barriers to fully embedding Start Work Check (SWC) as a human performance tool. First, as discussed under Theme 1, many workforces have only a partial conceptual understanding of "safeguards" and do not automatically associate Start Work Check (SWC) with a structured set of interdependent barriers. Without this conceptual foundation, Start Work Check (SWC) risks being treated as a checklist to satisfy procedural requirements rather than a framework for thinking about error-prone situations and human fallibility.

Second, Start Work Check (SWC) usage appears to be uneven across workforces and tasks. In some cases, Start Work Check (SWC) discussions are led actively by supervisors, while in others they are implied but not explicitly referenced. Where Start Work Check (SWC)s is not embedded in daily routines such as the galley workforces receive little exposure to the language of safeguards, Hold Point and Trigger Points, contributing to the conceptual gaps already noted.

Third, ownership of Start Work Check (SWC) is not always clear. Some workforces seemed to view Start Work Check (SWC) as something belonging to the company or to supervisors, rather than as a tool owned and driven by the frontline workforces. This perception undermines the shift in safety culture envisioned by organisations such as IOGP, where Start Work Check (SWC) is meant to place greater safety ownership in the hands of those closest to the work, thereby strengthening frontline accountability and resilience.

Overall, while Start Work Check (SWC) has begun to influence behaviour positively in certain areas, the study reveals that more work is needed to ensure that its principles are uniformly understood, consistently applied and fully integrated into everyday offshore practices.

Cognitive and social factors profoundly shape safeguard application. First-line supervisors (FLS) emerged as pivotal "cultural gatekeepers" who translate abstract policies into tangible actions. The use of positive reinforcement supports a "Just Culture," where emphasis shifts from individual blame to learning from systemic vulnerabilities. This aligns with the Safety-II paradigm.

Frontline workforces offered high-value interventions (e.g., galley one-way layout) reflecting an intuitive grasp of Human Factors Engineering (HFE). Yet, "None" responses for feedback suggest a lack of Psychological Safety the belief that one can speak up without risk of marginalisation. In high-risk environments, the absence of workforce voice can lead to the "normalisation of deviance"

4.6 Frontline Leadership and Psychological Safety

Supervisors emerged as "cultural gatekeepers" (VnV-01 through VnV-08). Where supervisors reinforced the "why" behind safeguards, situational awareness was higher. However, the tendency to report incidents later rather than immediately suggests a potential lack of psychological safety. Edmondson (2018) notes that without an environment where workforces feel safe to speak up, safeguards like Stop Work Authority (SWA) remain underutilized.

4.7 Synthesis of Research Findings

The study highlights a clear gap between work-as-imagined and work-as-done, where everyday practices often diverge from formal safety expectations. Error-prone situations appear to emerge not from a single failure, but from a combination of conceptual gaps, the normalisation of risky conditions, and reliance on informal experience. Although workforces were able to identify certain protective measures, these were not understood as part of an integrated and structured safety system. Environmental constraints, such as confined or complex workspaces, further shaped risk perception, leading to subjective underestimation of hazards over time. Hold and Trigger Points were applied inconsistently and were frequently associated with Job Safety Analysis rather than being clearly positioned at critical, unrecoverable stages of work, reducing their effectiveness as defensive layers within the Swiss Cheese Model. While tools such as SWC and LSR were present and supported positive safety behaviours, their use was often procedural, reflecting a "checklist mentality" rather than genuine risk engagement. In contrast, sites where supervisors actively reinforced expectations and provided timely feedback demonstrated stronger situational awareness and more consistent safety behaviours.

4.8 Summary of Chapter

This chapter presents key findings from observation-based research, revealing a clear gap between work-as-imagined and work-as-done in how offshore workforces understand and apply safeguards. Error-prone situations were found to arise not only from hazardous tasks and environmental constraints, but also from conceptual gaps in safeguard understanding, the normalisation of risk, and reliance on informal experience over structured human performance tools.

Although Hold Points and Trigger Points were generally recognised, their effectiveness was weakened by inconsistent definitions and unclear verification roles, reducing their function as defensive layers within the Swiss Cheese Model. Likewise, Start Work Checks (SWCs) and Life-Saving Rules (IOGP, 2025) supported positive behaviours such as stop-work actions and improved control of line-of-fire, energy isolation, and exclusion zones during lifting (VnV-06); however, their impact remained limited by a prevailing “checklist mentality” and weak frontline ownership

CHAPTER 5

CONCLUSION AND RECOMMENDATION

This chapter synthesises the key findings of the study, discusses its contributions to theory and practice, offers recommendations for offshore organisations and policymakers and identifies areas for future research. It also acknowledges the limitations of the research and concludes with reflections on the role of human performance in enhancing safeguard implementation and safety culture in offshore operations.

This study demonstrates that the effectiveness of offshore safeguards is shaped less by their formal presence and more by how they are cognitively understood and behaviourally enacted by frontline workforces. Bridging the gap between work-as-imagined and work-as-done therefore requires a shift from procedural compliance to active safeguard verification, supported by supervisory coaching and sustained workforce engagement.

5.1 Summary of key findings

The study concludes that preventing life-altering injuries depends on a strong human performance culture where safeguards are owned by those closest to the work. The analysis matrix revealed a significant conceptual gap in defining "unrecoverable steps" across the Tapis field workforce. The findings show that human performance factors play a decisive role in shaping how safeguards are understood and applied at the offshore worksite. Several interrelated conclusions emerge:

i. Workforces often possess only partial conceptual understanding of safeguards. Many workforces could name some protective measures such as PPE, gas detectors, isolation systems or pressurized habitat s but did not consistently see these as components of a structured system of defences as described by the Swiss Cheese Model.

ii. Error-prone situations arise from both environmental and cognitive cultural factors. Constrained spaces, slippery surfaces, simultaneous operations and complex tasks create objective risk, while normalisation of these conditions and over reliance on experience contribute to subjective underestimation of hazard.

iii. Hold Point and Trigger Points are familiar terms but inconsistently defined and applied. Workforces frequently associated Hold Point with Job Safety Analysis or Permit to Work (PTW) but could not clearly locate them at unrecoverable steps in task sequences, and while they recognised triggers such as alarms or equipment anomalies, they did not consistently link these to formal stop work and reassessment procedures.

iv. Start Work Check (SWC)s is present and sometimes effective, but their potential as a human performance tool is underutilised. Workforces and supervisors used Start Work Check (SWC) elements to support positive actions such as stopping work, controlling line of fire risks and enforcing energy isolation, yet Start Work Check (SWC)s remained unevenly understood and not fully owned by workforces as a frontline tool.

v. Supervisors' coaching and workforce engagement are critical enablers. Where supervisors actively reinforced expectations, explained Start Work Check (SWC) meaning and provided immediate feedback, workforces showed greater

awareness and stronger safety behaviours, including suggesting local improvements.

These findings confirm that improving offshore safety is not solely a matter of adding more technical controls but requires deliberate strengthening of human performance capabilities and safety culture at the point of risk.

5.2 Contributions of the study

5.2.1 Academic and Research contributions

This research makes a significant academic contribution by addressing a documented gap in the literature on work-as-done within offshore environments through empirical, observation-based evidence of workforce behaviour. Moving beyond the programme-level descriptions that dominate existing studies (Roberts & Flin, 2025), the findings provide insight into how offshore workforces understand and apply safeguards during both routine and high-risk tasks. While prior research has largely focused on Start Work Check (SWC) implementation or quantitative safety indicators such as Total Recordable Injury Rate (TRIR), this study foregrounds the everyday behaviours, interpretations, and decision-making processes that connect safety programmes to actual outcomes. Using a structured VnV Observation Checklist and thematic analysis, the study offers nuanced evidence on the practical enactment of safeguards, Hold Points, Trigger Points, and stop-work authority. It further strengthens the integration of the Swiss Cheese Model, Human Error Theory, situational awareness, and High Reliability Organisation (HRO) principles by demonstrating how latent conditions and active failures interact with human performance factors in shaping safety outcomes within complex sociotechnical systems.

5.2.2 Practical contributions

This research provides an observation-based account of work-as-done and presents a validated VnV Observation Checklist that connects organisational safety intent with field-level behaviours. The findings offer practitioners clear insight into both strengths and limitations in offshore safeguard implementation. Positive behaviours, including timely stop-work decisions, proactive correction of unsafe conditions, and constructive improvement suggestions from workforces, are evident and demonstrate how safeguards are enacted in practice.

The study identifies areas where safeguard effectiveness is constrained, including limited conceptual understanding, unclear verification roles, uneven utilisation of Start Work Checks (SWCs), and inconsistent application of Hold and Trigger Points. Together, these insights provide a grounded basis for understanding how offshore safety practices function in everyday operations and how gaps between formal requirements and actual practice continue to shape safety performance. The findings indicate that effective safeguard implementation depends less on procedural compliance and more on meaningful engagement at the point of work. Start Work Checks (SWCs) are most effective when used as interactive discussions that clarify worst-case risks, safeguards, and critical Hold and Trigger Points for specific tasks, rather than as administrative checklists. Safeguard verification emerges as a shared responsibility between workforces and first-line supervisors, supported through Permit to Work processes, toolbox talks, and task-level communication. Structured observation and coaching using tools such as the VnV Observation Checklist help surface human performance strengths and gaps, while reinforcement of stop-work decisions and opportunities for workforce feedback strengthen learning and ownership. Overall, shifting from a “tick-box” approach to critical dialogue enables a

clearer alignment between work-as-imagined and work-as-done by ensuring safeguards are actively understood, verified, and applied in practice.

Table 5.1
Summary of the Action Plan for Supervisors

Step	Action	Objective
1. Identify	Pinpoint the "unrecoverable step" where an error leads to a fatality	**Clarity:** Ensure everyone knows where work *must* stop for verification
2. Engage	Ask the workforce to "Tell me" the safeguard and "Show me" it is working	**Validation:** Move beyond the administrative "tick" to behavioural proof
3. Empower	Explicitly define the **Trigger Points** that require immediate stop-work	**Authority:** Grant permission to stop without fear of production pressure

ii. Policy and Training

The policy and training recommendations emphasise the need to better align organisational standards with frontline practice. Human performance concepts should be explicitly embedded within competency frameworks, with assessment methods shifting from written tests to practical, field-based evaluations that demonstrate understanding in real work situations. Procedures such as Job Safety Analysis (JSA), Permit to Work (PTW), and Start Work Checks (SWCs) should be periodically reviewed against observational data to ensure they reflect actual work sequences and hazards. The role of first-line supervisors should be formally recognised as central to human performance improvement, supported by structured tools and allocated time for coaching and debriefing. In addition, training programmes should prioritise

scenario-based learning using realistic offshore tasks to illustrate the application of safeguards, Hold Points, and Trigger Points in high-risk operations.

Table 5.2
Summary of Competency Framework Enhancements

Policy Area	Enhancement Requirement	Objective
1. Recruitment & Induction	Assessment of situational awareness and risk perception.	Ensure new hires recognize "weak signals."
2. Supervisor Training	Certification in "Show Me, Tell Me" coaching and VnV methodology.	Transform FLS into cultural gatekeepers.
3. Performance Reviews	Metrics for proactive "Stop Work" and improvement suggestions.	Foster a generative safety culture.

Policy and training recommendations focus on integrating human performance concepts into competency frameworks, ensuring that training and assessment address error-prone situations, human error mechanisms, Hold and Trigger Points, and stop-work authority using practical offshore examples. Procedures such as Job Safety Analysis, Permit to Work, and Start Work Checks should be periodically reviewed against observational data to ensure alignment with actual work practices and hazards. In addition, policies should formally support supervisors as key contributors to human performance improvement by providing appropriate training, time, and tools for observation, coaching, and debriefing.

5.3.3 For future research

Future research could extend this work by applying similar VnV-based observational studies across multiple offshore assets, organisations, and contractor groups to examine whether the patterns identified are context-specific or more widely generalisable. Combining observational methods with qualitative interviews or focus

groups would also provide deeper insight into workforce beliefs, motivations, and perceptions related to safeguards, Start Work Checks, and stop-work authority, including organisational and cultural influences not captured through observation alone. In addition, future studies could explore quantitative relationships between the quality of Start Work Checks and safety outcomes, such as Total Recordable Injury Rate (TRIR), near-miss reporting, or high-potential incident frequency, to strengthen empirical links between frontline practices and safety performance.

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APPENDIX A

Copy of Verification and Validation (VnV) Observation Checklist Findings

Observation No.1

Verification & Validation (VnV) Observation Checklist 1

Section 1 – General Information

Date	17/12/2025
Location / Platform	TaP
Task / Activity Observed	ME217 White Brucker -To Perform 6MPM and replace spare parts.
Observer	Perbagaran Jayabalan
Team/Worker (Observee)	SSI Team (Contractor)

Section 2 – Worker Engagement (Questions & Responses)

Q No	Guiding Question	Worker Response / Observation	Notes / Gaps Identified
1a	What are your safeguards (where can you have a quick reference) Understanding of Safeguards In place & Working On Demand (SWC [LSR – IOGP])? "Tell me, Show me"	Observation shows Maintenance Pendent has been installed, all access door is open, Personal floatation device in place, where by safeguards are found to be in place and now to test if safeguards work on demand by Show Me - Tell Me. Technician 1 unable to specify where can he refer to for a quick reference. Technician 2 gave a look of confusion and said not sure. Both struggled to identify what are safeguards, nevertheless after several questionings manage to say that they will be able to find them in PTW, JSA and Procedure	Both Technicians failed to articulate the part that Maintenance Pendent is one of the critical Safeguard for this activity. Unable to identify precisely what exactly Safeguards are and where he can find them. Answer we are looking for would be SWC [LSR Work Authorization – IOGP]
1b	Who is responsible in verifying safeguards?	Technician 1 said himself according to him, Technician 2 said yes only Technician 1 has to verify them	Actual answer supposed to be Frontline Workforce and First Line Supervisor
2a	Explain how **hold point check determined?**	Both Technician 1 and 2 mention a few things such as in JSA, PTW and work aid if work critical then we must identify Hold Points. When ask what Hold Point is exactly, both were unable to articulate	Actual answer is supposed to be, Hold Point will be determined when we are about to reach an unrecoverable step within a work – in this case will be before entering the Brucker
2b	Who authorizes the release after completing hold point checks?	According to him it would be whoever checks them, when ask who, technician 1 said the Permit Authorizer	Actual Hold Point checks shall be carried out by FLS [First Line Supervisor] and upon check and all safeguards are in place and works on demand work can continue to execution phase
3a	Any predetermine **trigger points identified**, identified before starting the work?	Answers are 'Yes', such as weather, when there is an alarm and if someone trip in the Brucker	The answers are not reflecting on actual safeguards reflection on Trigger Points as can be referred through each safeguard in SWC such as for this work the LSA identified would be Work Authorization
4a	When was the last time you stopped work/task or raised a concern? In what situation you need to **STOP work** on this job?	Both technicians have never stopped work before	Personnel could not really recall if ever he has ever stopped any work before
4b	What happened after the work was stopped?	NA	NA
5a	Did you **feel safe** during this work/task? Any concerns?	Yes, no concern	NA
5b	Why you feel like that?	Both explained they feel all are okay, nothing is unsafe	Complacency
6	What **improvements** would help you do for this task to work more safely / effectively?	No specific improvements but if can provide a blower to improve ventilation would help ease our work as we rely on natural ventilation which is variable	Good suggestions, to be highlighted during Daily Coordination Meeting for respective Supervisor's further management

Section 3 – Observer's Reflection

Q No	Reflection Question	Observation
1	Did I reinforce expectations clearly? How?	Coached the personnel why SWC is important as it saves lives, also why it helps us to understand what are our Safeguards are, that needs to be in place and work on demand
2	What where the positive reinforcement or coaching given? Explain?	Coached the personnel on what is SWC and why SWC is important in saving lives. Also explained step by step in the meaning of Safeguards related to Work Authorization

Observation No.2

Verification & Validation (VnV) Observation Checklist 2

Section 1 – General Information

Date	18/12/2025
Location / Platform	TaP
Task / Activity Observed	Hot Work in Pressurized Habitat
Observer	Perbagaran Jayabalan
Team/Worker (Observee)	Heavy Maintenance & Machinery [Construction]

Section 2 – Worker Engagement (Questions & Responses)

Q No	Guiding Question	Worker Response / Observation	Notes / Gaps Identified
1a	What are your safeguards (where can you have a quick reference) Understanding of Safeguards In place & Working On Demand (SWC [LSR – IOGP])? "Tell me, Show me"	Observation showed that Safeguards such as Gas test, Pressure Test on Pressurized Habitat, Continuous Gas Monitoring Devices, Fire Fighting Devices, Removal of Combustible Materials, Fire Watcher, Emergency Response Exercise and other are in Place, now to test if safeguards work on demand by Show Me - Tell Me. Welder fairly understands on safeguards even though could not identify where exactly safeguards can be referred to. Fire Watcher was able to provide answers such as Fire Hose Reel, Fire Extinguisher and Fire Blanket. Understandings such as Pressurized Habitat is to help prevent fire and explosion, Gas Detector and Fire Watcher to help protect seems to be the right answers but again could not articulate why and how	Unable to identify precisely what exactly all Safeguards for this task and where he can find them. Answer we are looking for would be SWC [LSR – IOGP]
1b	Who is responsible in verifying safeguards?	According to Fire Watcher this would be his Fitter Foreman	Actual answer supposed to be Frontline Workforce and First Line Supervisor
2a	Explain how **hold point check determined?**	Both Welder and Fire Watcher mention a few things such as in JSA, PTW, LSA and Procedure. Nevertheless, only Welder did more talking rather than the Fire Watcher. Welder also mentioned that if work is critical then we must identify Hold Points. When ask what Hold Point is exactly, he is unable to articulate	Actual answer is supposed to be, Hold Point will be determined when we are about to reach an unrecoverable step within a work – in this case will be before entering the Pressurized habitat
2b	Who authorizes the release after completing hold point checks?	According to Welder and Fire Watcher this would be their Fitter Foreman	Actual Hold Point checks shall be carried out by FLS [First Line Supervisor]
3a	Any predetermine **trigger points** identified before starting the work?	Fire Watcher mentioned weather, while Welder brough up when alarm raised off the Habitat Panel. When seek more information if there is any other Trigger the could not say further	The answers are not reflecting on actual safeguards reflection on Trigger Points as can be referred through each safeguard in SWC such as for this work the LSA identified would be Hot Work
4a	When was the last time you stopped work/task or raised a concern? In what situation you need to **STOP work** on this job?	Previous Habitat when there was an alarm due to reduced pressure on the Pressurized Habitat.	Personnel have the answer but could not related back to the why part. Understanding why would be an important part of a complete understanding. They also failed to mention to call the Supervisors as required by SWC
4b	What happened after the work was stopped?	When asked what was done, they mentioned that the called Habitat Technician and repaired and continue the work	Personnel were asked if Supervisor was informed, they responded that they did not and only mention that they informed when meet the Foreman sometime later
5a	Did you **feel safe** during this work/task? Any concerns?	Yes, no concern	NA
5b	Why you feel like that?	They claim this is a usual work and this is how they have been doing for a very long time and all is good	Complacency
6	What **improvements** would help you do for this task to work more safely / effectively?	None	NA

Section 3 – Observer's Reflection

Q No	Reflection Question	Observation
1	Did I reinforce expectations clearly? How?	Coached the personnel why SWC is important as it saves live also why it helps us to understand what are our Safeguards that needs to be in place and work on demand
2	What where the positive reinforcement or coaching given? Explain?	Coached the personnel on what is SWC and why SWC is important in saving lives. Also explained step by step in the meaning of Safeguards related to Hot Work

Observation No.3

Verification & Validation (VnV) Observation Checklist 3

Section 1 – General Information

Date	18/12/2025
Location / Platform	Tapis-D LQ Lv3
Task / Activity Observed	Troubleshoot Abnormal Noise & Rectification work on AHU
Observer	Perbagaran Jayabalan
Team/Worker (Observee)	Alam Dingin

Section 2 – Worker Engagement (Questions & Responses)

Q No	Guiding Question	Worker Response / Observation	Notes / Gaps Identified
1a	What are your safeguards (where can you have a quick reference) Understanding of Safeguards In place & Working On Demand (SWC [LSR – IOGP])? "Tell me, Show me"	Observation shows Isolations (LOTO), Zero Energy Demonstration, Breaking Containment identification and crack open locations identified and marked on site, safe crack open method has been established, where by safeguards are found to be in place and now to test if safeguards work on demand by Show Me - Tell Me. Moderate understanding on safeguards even though could not identify where exactly safeguards can be referred to. Reply came off Technician 1 and 2 that System and Electrical Isolations must be carried out with Zero Energy Demonstration. Bump Test on Gas Detector were mentioned but unable to articulate why	Unable to identify precisely what exactly all Safeguards for this task and where he can find them. Answer we are looking for would be SWC [LSR – IOGP]
1b	Who is responsible in verifying safeguards?	According to Both Technicians would be both their responsibility, still in accurate	Actual answer supposed to be Frontline Workforce and First Line Supervisor
2a	Explain how **hold point check determined?**	Technician 1 mention a few things such as in JSA, PTW, LSA and Procedure. While Technician 2 said that Hold Point must be identified. When ask what Hold Point is exactly, both unable to articulate the exact answer	Actual answer is supposed to be, Hold Point will be determined when we are about to reach an unrecoverable step within a work – in this case will be before crack open the pressurized system such as pipe flange, valves or any other system
2b	Who authorizes the release after completing hold point checks?	According to Technician 1 would be the Area Authority who carried out the final check for PTW approval at site. Technician 2 agreed by nodding his head	Actual Hold Point checks shall be carried out by FLS [First Line Supervisor]
3a	Any predetermine **trigger points** identified before starting the work?	Answers was 'Yes' by Technician 2, he then elaborated conditions such as when he hears hissing sounds even after isolation has been achieved or sparks when	The answers are not reflecting on actual safeguards reflection on Trigger Points as can be referred through each safeguard in SWC such as for this work
		removing any cables that would be his Trigger Points, Technician 1 on another hand mentioned that weather change is a Trigger Point for him. Nevertheless, when ask why or what he will do, he could not articulate a much precise answer	the LSA identified would be Energy Isolation & Breaking Containment
4a	When was the last time you stopped work/task or raised a concern? In what situation you need to **STOP work** on this job?	Never stopped work before	Personnel could not really recall if ever he has ever stopped any work before
4b	What happened after the work was stopped?	NA	NA
5a	Did you **feel safe** during this work/task? Any concerns?	Yes, no concern	Complacency
5b	Why you feel like that?	NA	NA
6	What **improvements** would help you do for this task to work more safely / effectively?	None	NA

Section 3 – Observer's Reflection

Q No	Reflection Question	Observation
1	Did I reinforce expectations clearly? How?	Coached the personnel why SWC is important as it saves live also why it helps us to understand what are our Safeguards that needs to be in place and work on demand
2	What where the positive reinforcement or coaching given? Explain?	Coached the personnel on what is SWC and why SWC is important in saving lives. Also explained step by step in the meaning of Safeguards related to work Energy Isolation & Breaking Containment

Observation No.4

Verification & Validation (VnV) Observation Checklist 4

Section 1 – General Information

Date	19/12/2025
Location / Platform	Galley / TaD
Task / Activity Observed	Cooking
Observer	Perbagaran Jayabalan
Team/Worker (Observee)	Alfa Meli

Section 2 – Worker Engagement (Questions & Responses)

Q No	Guiding Question	Worker Response / Observation	Notes / Gaps Identified
1a	What are your safeguards (where can you have a quick reference) Understanding of Safeguards In place & Working On Demand (SWC [LSR – IOGP])? "Tell me, Show me"	Observation shows non slippery floor, all materials sharp items or things that could harm are stored safely, hot surfaces are marked clearly, no food safety are at concern, where by safeguards are found to be in place and now to test if safeguards work on demand by Show Me - Tell Me. The cook has zero understanding on safeguards, seems that he has never heard the word safeguards before. Nevertheless, when triggered with few more questions he was referring to Personnel Protective Equipment only.	Unable to identify precisely what exactly all Safeguards for this task and where he can find them. Answer we are looking for would be SWC [LSR – IOGP]
1b	Who is responsible in verifying safeguards?	Could not answer	Actual answer supposed to be Frontline Workforce and First Line Supervisor
2a	Explain how **hold point check determined**?	Cook mention a few things such as in JSA, PTW, LSA and Procedure. Nevertheless, he is unable to articulate the exact answer, seems he have heard Hold Point before	Actual answer is supposed to be, Hold Point will be determined when we are about to reach an unrecoverable step within a work – in this case will be before starting the cookery or hot surface
2b	Who authorizes the release after completing hold point checks?	According to him would be the Camp Boss	Actual Hold Point checks shall be carried out by FLS [First Line Supervisor]
3a	Any predetermine **trigger points** identified before starting the work?	Answers are 'Yes', such as when he touches a hot surface or a simple slip that would be his Trigger Points, nevertheless when ask why or what he will do, he could not articulate a much precise answer	The answers are not reflecting on actual safeguards reflection on Trigger Points as can be referred through each safeguard in SWC such as for this work the LSA identified would be Line of Fire
4a	When was the last time you stopped work/task or raised a concern? In what situation you need to **STOP work** on this job?	Yes, he has stopped work before during carrying materials from container where some personnel were not on proper Personal Protective Equipment	His narrative on Stop Work could only be related to Personal Protective Equipment and nothing beyond that
4b	What happened after the work was stopped?	The personnel goes and don required Personal Protective Equipment	Again, the focus is on Personal Protective Equipment only
5a	Did you **feel safe** during this work/task? Any concerns?	Yes, but a small concern on limited space and number of workers working at the same place	To highlight matter to Camp Boss
5b	Why you feel like that?	Space is limited and slippery sometimes	To highlight matter to Camp Boss
6	What **improvements** would help you do for this task to work more safely / effectively?	Rearrange the set up to make a one-way kind of operation to avoid bump into each other	Strong suggestion on worksite improvement

Section 3 – Observer's Reflection

Q No	Reflection Question	Observation
1	Did I reinforce expectations clearly? How?	Coached the personnel why SWC is important as it saves live also why it helps us to understand what are our Safeguards that needs to be in place and work on demand
2	What where the positive reinforcement or coaching given? Explain?	Coached the personnel on what is SWC and why SWC is important in saving lives. Also explained step by step in the meaning of Safeguards related to Line of Fire

Observation No.5

Verification & Validation (VnV) Observation Checklist 5

Section 1 – General Information

Date	20/12/2025
Location / Platform	Tapis E Cellar Deck
Task / Activity Observed	Power Tooling, Spot Blast - MIT & Wrapping activity [Abseiling]
Observer	Perbagaran Jayabalan
Team/Worker (Observee)	Heavy Maintenance & Machinery [Painting]

Section 2 – Worker Engagement (Questions & Responses)

Q No	Guiding Question	Worker Response / Observation	Notes / Gaps Identified
1a	What are your safeguards (where can you have a quick reference) Understanding of Safeguards In place & Working On Demand (SWC [LSR – IOGP])? "Tell me, Show me"	Observation shows air hose being used with proper whip check to prevent whipping, area has been barricaded, no combustible materials in close proximity, Spot blasting equipment inspection checklist has been signed off, where by safeguards are found to be in place and now to test if safeguards work on demand by Show Me - Tell Me. Observation shows that there is always a Team Leader at site and a Standby Person dedicated to help monitor the activity. Moderate understanding on safeguards even though could identify where exactly are safeguards can be referred to which is SWC. Nevertheless, unable to articulate why they are important	Able to identify where can the Safeguards be found, nevertheless unable to precisely identify what Safeguards are for this task. Answer we are looking for would be SWC [LSR – IOGP] at the Line of Fire
1b	Who is responsible in verifying safeguards?	According to the Technician he and his Standby Person would be responsible	Actual answer supposed to be Frontline Workforce and First Line Supervisor
2a	Explain how **hold point check determined?**	Technician mention SWC can tell us where to find Hold Point, nevertheless when we went through SWC he is unable to point out where exactly. When ask what Hold Point is exactly, he is unable to articulate the exact answer	Actual answer is supposed to be, Hold Point will be determined when we are about to reach an unrecoverable step within a work – in this case will be before operating the air line for both spot blasting and power tooling
2b	Who authorizes the release after completing hold point checks?	According to him would be the Area Authority who carried out the final check for PTW approval at site	Actual Hold Point checks shall be carried out by FLS [First Line Supervisor]
3a	Any predetermine **trigger points** identified before starting the work?	Answers are 'Yes', such as when he hears alarm, loud sound coming from the device he is operating, and weather. Good answer, nevertheless, when ask why or	The answers are not reflecting on actual safeguards reflection on Trigger Points as can be referred through each safeguard in SWC such as for this work the LSA identified would be Line of Fire
		what he will do, he could not articulate a much precise answer	
4a	When was the last time you stopped work/task or raised a concern? In what situation you need to **STOP work** on this job?	Stopped work yesterday when his scaffolder had his anchor point at one point during change of position at work became below hip. Alerted him to rise up his anchor point to a higher point above his head	Personnel really did a great job and when asked do you think that was a Trigger Point, he could not really understand if it was. He did stop the work but failed to call FLS as that is how it should work
4b	What happened after the work was stopped?	Personnel immediately act to change his anchor point to a higher point	Good job
5a	Did you **feel safe** during this work/task? Any concerns?	Yes, no concern	Complacency
5b	Why you feel like that?	NA	NA
6	What **improvements** would help you do for this task to work more safely / effectively?	None	NA

Section 3 – Observer's Reflection

Q No	Reflection Question	Observation
1	Did I reinforce expectations clearly? How?	Coached the personnel why SWC is important as it saves live also why it helps us to understand what are our Safeguards that needs to be in place and work on demand
2	What where the positive reinforcement or coaching given? Explain?	Coached the personnel on what is SWC and why SWC is important in saving lives. Also explained step by step in the meaning of Safeguards related to Line of Fire

Observation No.6

Verification & Validation (VnV) Observation Checklist 6

Section 1 – General Information

Date	21/12/2025
Location / Platform	Tapis D [Main Deck]
Task / Activity Observed	Lifting Routine
Observer	Perbagaran Jayabalan
Team/Worker (Observee)	Crane and Rigging Team

Section 2 – Worker Engagement (Questions & Responses)

Q No	Guiding Question	Worker Response / Observation	Notes / Gaps Identified
1a	What are your safeguards (where can you have a quick reference) Understanding of Safeguards In place & Working On Demand (SWC [LSR – IOGP])? "Tell me, Show me"	Observation shows exclusion zone has been identified, barricading in place, standby person or signal man is in place, communication means are established, where by safeguards are found to be in place and now to test if safeguards work on demand by Show Me - Tell Me. Crane Operator Moderately understands on safeguards and able to identify where exactly are safeguards can be referred to SWC. Signal Man and Rigger on the other had looked as though the followed the Crane Operators answer. Understanding the risk of lifting such as drop objects, nobody should be touching load and place themselves under suspended load are there but again could not articulate why	Able to identify precisely where to find safeguards, nevertheless unable to answer why
1b	Who is responsible in verifying safeguards?	According to Crane Operator he would be, while the Rigger and Signal Man this would be the Crane Operator's responsibility	Actual answer supposed to be Frontline Workforce and First Line Supervisor
2a	Explain how **hold point check determined**?	Crane Operator and his team mates answered that they can find in JSA, PTW and Procedure but unable to pinpoint what is Hold Points, unable to articulate	Actual answer is supposed to be, Hold Point will be determined when we are about to reach an unrecoverable step within a work – in this case will be before Crane Operator climbs up the crane ladder
2b	Who authorizes the release after completing hold point checks?	According to Crane Operator he would authorize after completing	Actual Hold Point checks shall be carried out by FLS [First Line Supervisor]
3a	Any predetermine **trigger points** identified before starting the work?	Signal Man answered are 'Yes', weather condition such as wind speed and sea condition if working with vessel. Crane Operator added that if any of the lifting gears found to broke off when lifting. Rigger could not answer. They did not use the SWC to articulate thoroughly even most of the answers are correct	The answers are not reflecting on actual safeguards reflection on Trigger Points as can be referred through each safeguard in SWC such as for this work the LSA identified would be Lifting
4a	When was the last time you stopped work/task or raised a concern? In what situation you need to **STOP work** on this job?	Signal man and Rigger answered will stop if found someone entered the Exclusive Zone [Lifting]. Yes, they have done before as it is prohibited. When ask why they said dangerous but unable to tell further, which is unable to precisely lead the conversation that someone can be killed. Crane Operator did not participate in answering as he said most of the time, he has his Riggers and Signal Man to help on these matters	Personnel have the answer but could not related back to the why part. Understanding why would be an important part of a complete understanding
4b	What happened after the work was stopped?	Personnel will move away and when ask if he will report to Supervisor, he claims he will during meetings only	Supervisor must be informed, immediately for prompt action where Stop Work shall be recorded
5a	Did you **feel safe** during this work/task? Any concerns?	Yes, no concern	Complacency
5b	Why you feel like that?	NA	NA
6	What **improvements** would help you do for this task to work more safely / effectively?	Wish to get help in ordering a push pull stick as difficult to get replacement	To bring up to Maintenance Supervisor

Section 3 – Observer's Reflection

Q No	Reflection Question	Observation
1	Did I reinforce expectations clearly? How?	Coached the personnel why SWC is important as it saves live also why it helps us to understand what are our Safeguards that needs to be in place and work on demand
2	What where the positive reinforcement or coaching given? Explain?	Coached the personnel on what is SWC and why SWC is important in saving lives. Also explained step by step in the meaning of Safeguards related to Lifting

Observation No.7

Verification & Validation (VnV) Observation Checklist 7

Section 1 – General Information

Date	22/12/2025
Location / Platform	Tapis P [Production Deck]
Task / Activity Observed	Breaking Containment to Replace Gasket
Observer	Perbagaran Jayabalan
Team/Worker (Observee)	CMPE Team

Section 2 – Worker Engagement (Questions & Responses)

Q No	Guiding Question	Worker Response / Observation	Notes / Gaps Identified
1a	What are your safeguards (where can you have a quick reference) Understanding of Safeguards In place & Working On Demand (SWC [LSR – IOGP])? "Tell me, Show me"	Observation Isolations are in place with Lock Out Tag Out seen, Document shows that Zero Energy Demonstration has been concluded, Gas Test has also been concluded and source of ignition has been checked and verified unavailable, where by safeguards are found to be in place and now to test if safeguards work on demand by Show Me - Tell Me. Technician 1 and 2 moderately understands on safeguards and able to identify where exactly safeguards can be referred to SWC. Understanding the risk of breaking containment sudden release of hydrocarbon, major leak of residuals, high pressure release and injuring personnel and also on portable air compressor such as sudden release of pressure, line of fire and being struck by whipping hose if under pressure, able to articulate why but vague answers	Able to identify precisely where to find safeguards, nevertheless answers are vague and unclear why
1b	Who is responsible in verifying safeguards?	According to both the Technicians would be the Permit Authorizer	Actual answer supposed to be Frontline Workforce and First Line Supervisor
2a	Explain how **hold point check determined**?	Answer was correct that they should predetermine Hold Point, nevertheless unable to articulate the complete answer on where they have determine or why	Actual answer is supposed to be, Hold Point will be determined when we are about to reach an unrecoverable step within a work – in this case will be before Breaking Containment
2b	Who authorizes the release after completing hold point checks?	According to technician 1 would be his supervisor, correct answer. Then Technician 2 mentioned they should be able to. Then why the answer above both could not answer further	Supervisor or FLS [First Line Supervisor] is the correct answer
3a	Any predetermine **trigger points** identified before starting the work?	Answers are 'Yes' by both, such as excessive air gushing when breaking containment, unable to break containment using normal approach and others. Used SWC but unable to articulate thoroughly most of the answers even when referring to SWC	The answers are not reflecting on actual safeguards reflection on Trigger Points as can be referred through each safeguard in SWC such as for this work the LSA identified would be Energy Isolation & Breaking Containment
4a	When was the last time you stopped work/task or raised a concern? In what situation you need to **STOP work** on this job?	Technician 2 said yes, stop my colleague once when he was about to remove LOTO when the work has not been completed. When ask why he wanted to remove the LOTO his colleague said he trusted work was completed. Able to precisely say that someone can be killed	Commendable act as he understands the importance of Energy Isolation
4b	What happened after the work was stopped?	Personnel stopped and agreed on the unsafe act. When ask if he reported to Supervisor, he claims he did but during After Action Review	Supervisor must be informed, immediately for prompt action where Stop Work shall be recorded
5a	Did you **feel safe** during this work/task? Any concerns?	Yes, no concern	Complacency
5b	Why you feel like that?	NA	NA
6	What **improvements** would help you do for this task to work more safely / effectively?	NA	NA

Section 3 – Observer's Reflection

Q No	Reflection Question	Observation
1	Did I reinforce expectations clearly? How?	Reinforced the understanding of why SWC is important as it saves live also why it helps us to understand what are our Safeguards that needs to be in place and work on demand.
2	What where the positive reinforcement or coaching given? Explain?	Coached the personnel on what is SWC and why SWC is important in saving lives. Also explained step by step in the meaning of Safeguards related to Energy Isolation & Breaking Containment

Observation No.8

Verification & Validation (VnV) Observation Checklist 8

Section 1 – General Information

Date	22/12/2025
Location / Platform	Tapis-D [Production Deck]
Task / Activity Observed	QC-To perform IR Gas Leak inspection on all module
Observer	Perbagaran Jayabalan
Team/Worker (Observee)	QC Team

Section 2 – Worker Engagement (Questions & Responses)

Q No	Guiding Question	Worker Response / Observation	Notes / Gaps Identified
1a	What are your safeguards (where can you have a quick reference) Understanding of Safeguards In place & Working On Demand (SWC [LSR – IOGP])? "Tell me, Show me"	Observation shows that the QC was working alone and did not have a buddy, nevertheless he is not closing into any critical areas of the worksite. He has a personal gas detector on himself, bump test concluded and he did not move backwards when he was doing his work, where by safeguards are found to be in place and now to test if safeguards work on demand by Show Me - Tell Me. Moderately understands on safeguards but unable to identify where exactly safeguards can be referred to. Able to explain how to prevent leak from harming himself. If leak detected within 3 meters distance, use PGD to detect LEL percentage. If more than 10% LEL, directly reported to CCR instead of getting closer to the leak source. Understanding is narrowed towards leak only	Unable to identify precisely where to find safeguards, nevertheless answers on leak was good
1b	Who is responsible in verifying safeguards?	According to him would be himself	Actual answer supposed to be Frontline Workforce and First Line Supervisor
2a	Explain how **hold point check determined?**	Answer was correct that they should predetermine Hold Point, nevertheless unable to articulate the complete answer on where they have determined or why	Actual answer is supposed to be, Hold Point will be determined when we are about to reach an unrecoverable step within a work – in this case will be before the actual pumping of pressure
2b	Who authorizes the release after completing hold point checks?	According to him would be his supervisor, correct answer. Then why the answer above cannot be answered unable to answer	Supervisor or FLS [First Line Supervisor] is the correct answer
3a	Any predetermine **trigger points** identified before starting the work?	Answers are 'Yes', such as air gushing in between flanges or connections, nevertheless unable to articulate thoroughly most of the answers or where to refer to - SWC	The answers are not reflecting on actual safeguards reflection on Trigger Points as can be referred through each safeguard in SWC such as for this work the LSA identified would be Line Of Fire
4a	When was the last time you stopped work/task or raised a concern? In what situation you need to **STOP work** on this job?	Yes, stop my colleague once when he was about to close into a leaked segment. When ask why he wanted to close into the leaked segment, was this predetermined, he said yes but his auto piloting led him to safe the situation instead of saving himself maybe. Able to precisely say that someone can be killed	Commendable act as he understands the importance of Line Of Fire
4b	What happened after the work was stopped?	Personnel stopped and agreed on the unsafe act. When ask if he reported to Supervisor, he claims he did but during After Action Review	Supervisor must be informed, immediately for prompt action where Stop Work shall be recorded
5a	Did you **feel safe** during this work/task? Any concerns?	Yes, no concern	Complacency
5b	Why you feel like that?	NA	NA
6	What **improvements** would help you do for this task to work more safely / effectively?	Thermal Infra-Red Scanners provided to help during their checks which would give them much help during certain leak checks	To bring up to Maintenance Supervisor

Section 3 – Observer's Reflection

Q No	Reflection Question	Observation
1	Did I reinforce expectations clearly? How?	Coached the personnel why SWC is important as it saves live also why it helps us to understand what are our Safeguards that needs to be in place and work on demand
2	What where the positive reinforcement or coaching given? Explain?	Coached the personnel on what is SWC and why SWC is important in saving lives. Also explained step by step in the meaning of Safeguards related to Line Of Fire

APPENDIX B

Photos of Engagement at Offshore site

Photo 1: Observation During Working at Height Activity

Photo 2: Observation During Routine Lifting Activity

Photo 3: Observation During Troubleshoot Abnormal Noise & Rectification work on Air Handling Unit

Photo 4: Observation During Power Tooling, Spot Blast - MIT & Wrapping activity [Abseiling]

Photo 5: Observation During QC-To perform IR Gas Leak inspection on all module

Photo 6: ME217 White Brucker -To Perform 6MPM and replace spare parts.

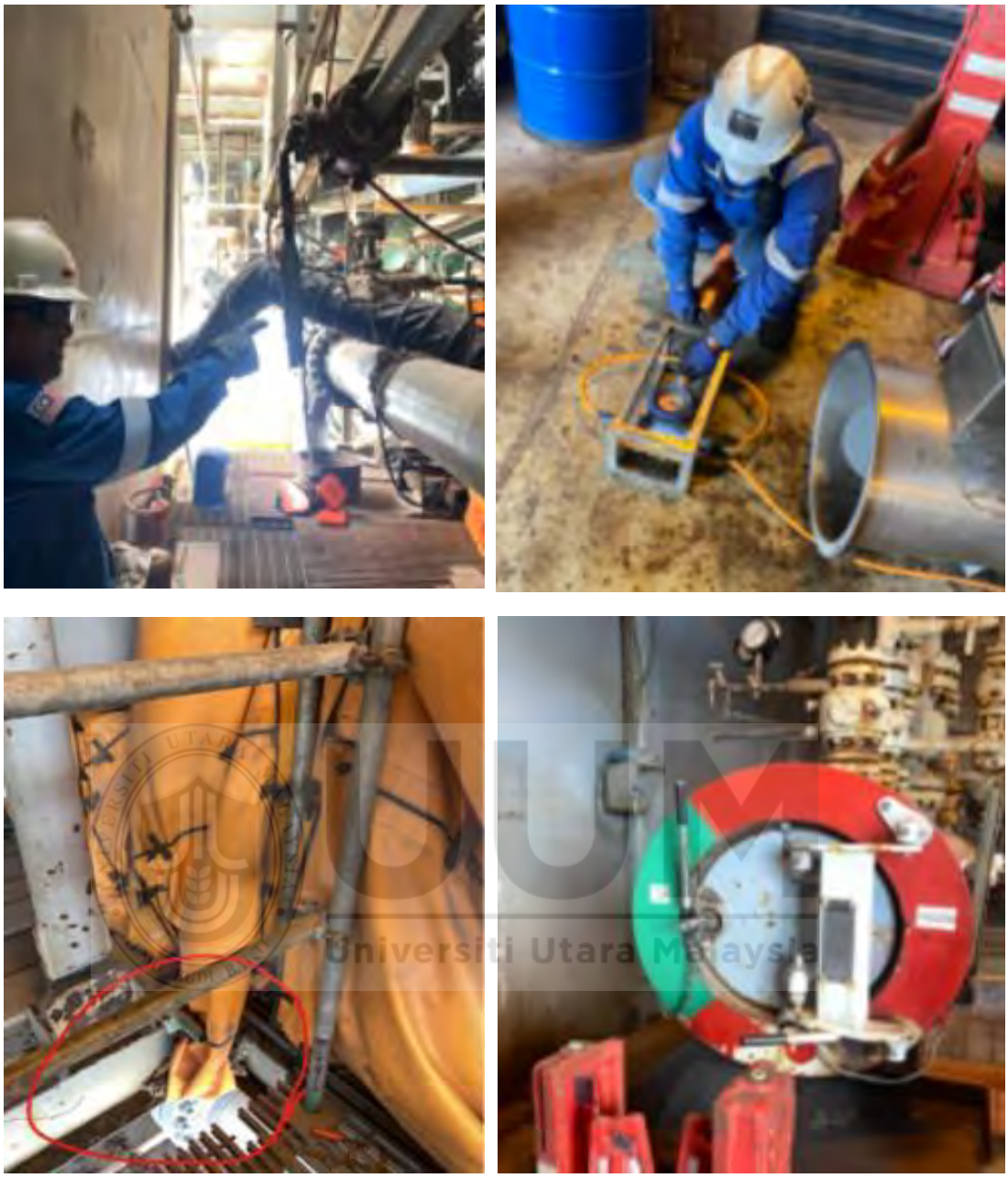

Photo 7: Observation during Hot Work in Pressurized Habitat