



ASSESSING OPERATIONAL ACCIDENT PATTERNS AND WORKERS' COMPLIANCE WITH SAFETY PRACTICES IN SELECTED ONSHORE OIL FIELD OPERATIONS IN DELTA STATE, NIGERIA

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Abstract

Despite the advances made in technology and work practices in the oil field industry, there is still a high level of concern with regard to operational accidents that can result from equipment, hazardous materials, and human actions all occurring in the context of a work system, where the loss of a single facet could lead to personal injury, production losses, and environmental damage. This study identified, ranked, and evaluated operational accidents in selected onshore oil fields in Delta State, Nigeria, and examined the extent of workers' adherence to safety practices. A cross-sectional descriptive survey was employed with operational employees selected from two oil-producing companies, and the questionnaire adopted was a structured questionnaire which was validated by Academic and Industry experts in the field. A valid sample of 302 workers responded, and their responses were analysed using frequencies and percentages, a mean score, and Pearson Product-Moment correlation. Equipment failure or malfunction was the most commonly reported accident type, with 70.2%, followed by gas leak or fume exposure with 61.3% and oil spill or leakage with 55.0%. The highest mean for accident frequency was exposure to hazardous conditions, with a mean score of 2.90, followed by minor incidents or near misses (mean score 2.89) and major accidents (mean score 2.36). Personal protective equipment uses (PPE) had a mean score of 4.11, use of approved safety procedures had a mean score of 4.03, SOP and work permit requirements had a mean score of 3.91, and safety meetings and toolbox talks had a mean score of 3.96, while prompt hazard reporting had a mean score of 3.85. A significant negative correlation of accident frequency with compliance ($r = -0.410$, $p < 0.001$) was found, and the result indicates that the higher the compliance, the lower the number of operational accidents reported. Results have shown that behavioural compliance is critical and must be complemented by reliable equipment, effective hazard reporting, and effective operational control.

Keywords:

Accident frequency, Oil field operations, Operational accidents, Safety compliance, Safety practices.

1. INTRODUCTION

The presence of high-pressure systems, flammable products, rotating equipment, electrical installations, chemical substances, and extreme work schedules implies that the safety of the operations is not just dependent on written procedures, but on reliable equipment, simple procedures, and disciplined behavior during each task. From contact with transport movements and equipment, fall hazards, or fire and gas release, workers can be exposed to immediate risks or to less obvious exposures that can result in a long-term health threat. The study by Benson *et al.* (2021) revealed that Nigerian oil and gas workers are exposed to various categories of occupational hazards, of which physical occupational hazards and chemical occupational hazards were among the major categories of hazards experienced. The industry internationally still maintains separate tracking for personal injuries and process-safety events, as an organisation can log few personal injuries and still be vulnerable to a large loss of containment, as is the current practice of the International Association of Oil and Gas Producers (IOGP, 2025).

In such an environment, accident prevention will involve more than just monitoring for rare cases of disaster; equipment failures, small releases, and unsafe conditions, as well as near misses, can also act as warning signs to identify weaknesses that could lead to more serious accidents. The studies conducted by Aydin *et al.* (2022) demonstrated that the fire and explosion risk in oil and gas systems is formed by various failure modes that are connected and should be systematically identified, ranked, and not considered a single technical issue. Human and organisational conditions have also been seen in the field as one of the influences in determining safety because, according to Fabiano *et al.* (2022), conditions that influence safety are in the form of human conditions and conditions related to work equipment. Although these arguments do not eliminate the worker's personal responsibility for an accident, they do illustrate how an accident may be more than just an individual error and could be attributed to the work system as well, through poor maintenance, poorly understood control measures, and lack of feedback.

The challenges of operating under ageing assets, challenging geography, spread-out facilities, and lack of a reliable source of incident information add to the difficulties of controlling operational risk in the Niger Delta region of Nigeria, making formal safety arrangements more of a hindrance than a help in the day-to-day work of the field. Several hazard and risk issues were identified in the activities of the NPDC Flow Station in Ogini, Delta State, and the need to be proactive in controlling or being prepared was emphasized (Asomaku *et al.*, 2021). Recent data from the frontline workers in the Niger Delta indicates that safety management practices are highly associated with safety compliance and participation, but when production demands and fear to report/reporting and varying management commitment are put into consideration, the behaviour expected from workers is compromised (Ehiaguina *et al.*, 2024). The issue is thus not so much whether oil companies have safety policies, but whether they are able to make safety measures reliable actions in maintenance, production, transport, and emergency situations.

One important way in which formal safety arrangements are made apparent in daily work is through workers' compliance – requirements for PPE, work permits, hazard reporting, 'toolbox' meetings, etc. have little impact if only performed at an audit or after an incident. Benson *et al.* (2022) mentioned that the concepts of safety supervision, access to safety systems, and competence of the employees are closely related to compliance in the oil and gas industry. Furthermore, evidence from Malaysia suggests that training, workers' involvement, communication, management commitment, and safety rules have impacts on occupational accidents through their impact on safety compliance (Ajmal *et al.*, 2022). This connection should be read with care because there is no guarantee that high levels of self-reported compliance reflect proper compliance with all procedures, and workers may answer questions in a socially desirable manner when those questions relate to one or more procedures the employer explicitly mandates.

The method for counting accidents is also important, as near misses, small releases, and unsafe situations may not be considered to be accidents and hence not documented in formal reports, whereas they are important indicators of the state of a safety system. Low-severity incidents and near misses in industrial workplaces were often not reported due to various reasons, including that the incident was considered unimportant, and workers were reluctant to report for fear of the consequences of reporting, according to Ghahramani *et al.* (2025). Official accident figures may only show the tip of the iceberg if the same issue exists in oil field operations, and workers' own firsthand experiences can show an increase or decrease in the trend of exposure. Sure, survey evidence isn't as comprehensive as verified company records; it can be used to detect if employees are encountering equipment malfunctions, gas exposures, spills, and other events that warrant investigation.

Equipment integrity is especially critical since the workers cannot make up for the lack of integrity in machinery, piping, or control systems indefinitely, even if they themselves are quite compliant. Operational boundaries, cost considerations, skill deficiencies, and a lack of resources make maintenance personnel in southern Nigeria, for instance, opt to deviate from the manufacturer's guidelines sometimes, while taking into account equipment reliability and safety (Okirie *et al.*, 2024). This implies that if a person is exposed to a condition due to a mechanical failure, they can be exposed to that condition even if PPE is worn, but if a person is exposed because of a failure in the permit process, then PPE use won't correct the process. The types and frequencies of accidents experienced should therefore be combined with another indicator, behavioural compliance, in a useful assessment.

Considering the extent of similarities and differences between the two locations, other research conducted in Africa that explored safety outcomes in other oil and gas settings will be reviewed. These are congruent, as Ofori *et al.* (2023) highlighted management and organisational measures as significant factors that influence safety outcomes in the Ghana oil and gas industry. Furthermore, Naji *et al.* (2026) found that safety culture has an impact on safety performance in Upstream Petroleum Exploration and Production, with management commitment, leadership, communication, and worker involvement and work environment playing significant roles. While these findings are applicable to the Nigerian context, the differences in certain regulations, asset condition, workforce arrangements, and local operating conditions imply that data from another country cannot be applied directly to onshore Delta State operations without local data.

The present study fulfilled this need by focusing on what workers reported experiencing in the past year and how consistently they reported following the safety practices expected in their work. Its contribution is to link what is reported where there is an accident with what compliance is observed in the same operational context, and not to take the existence of safety rules as an indicator of their effectiveness. The analysis also distinguishes between common occurrence and severity: an event that occurs less often, like a fire or explosion, might have more serious consequences than a more frequent equipment malfunction, and there should be a more powerful response to the less common, but more serious, event. Specifically, the study sought to: identify the common types of operational accidents in selected onshore oil field operations in Delta State, determine the frequency of operational accidents in the selected onshore oil field operations; and assess workers' level of compliance with safety practices in the selected onshore oil field operations. The hypothesis raised was that there is no significant relationship between workers' compliance with safety practices and the frequency of operational accidents in selected onshore oil field operations in Delta State, Nigeria.

2. METHODOLOGY

2.1 Study Area and Research Design

The study was carried out in Delta State, which is one of the petroleum production centres in Nigeria's Niger Delta, with drilling, extraction, processing, pipelines, maintenance, and support jobs exposing the workers to mechanical, chemical, electrical, and process hazards. A cross-sectional descriptive survey design was used, as the study required quantitative information from a specific workforce at one point in time, and a correlational test of the association between accident occurrence and the rate of adherence to safety measures. This design enabled the study to describe the conditions reported by the workers but not the temporal order necessary to draw a causal conclusion.

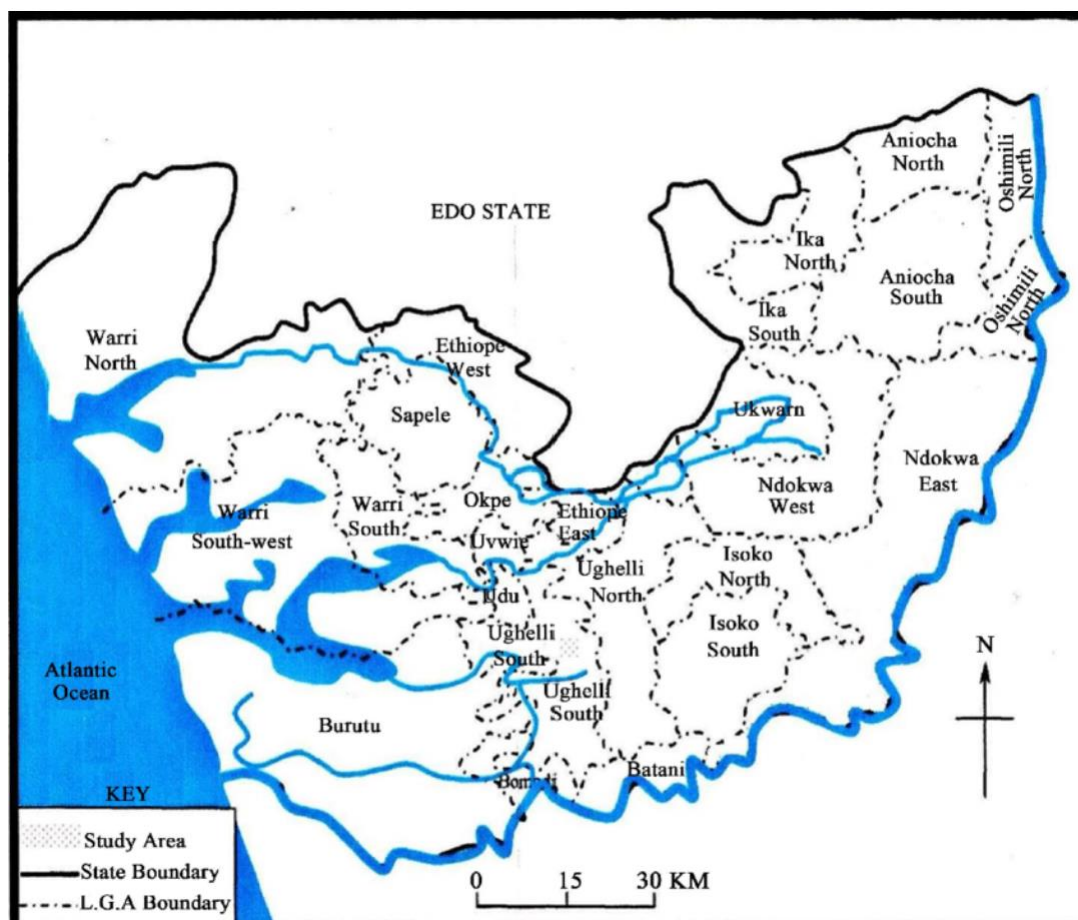


Figure 1 Map of Delta State (Source: Esinulo et al., 2016)

2.2 Population, Sample Size and Sampling Procedure

The study population comprised about 1250 workers engaged in various productive activities at two selected oil-producing companies in Delta State, including those involved in drilling, production, pipeline, and maintenance work, as well as supervisors and safety officers. An initial sample size of about 303 was determined using a 5% margin of error with Taro Yamane's formula; allowing for 10% non-response led to a planned sample size of 333. Purposive selection of the two companies was made based on the operational and access criteria; the sample proportionate to the number of workforces was allocated, and selection of eligible workers was done through simple random sampling by following a multi-stage procedure. Only full-time working employees who had been working for at least six months continuously at the business were chosen to ensure that the respondents had enough knowledge about the safety arrangements of the company.

2.3 Research Instrument, Validity and Reliability

A structured questionnaire named Assessment of Safety Practices and Operational Accidents in Oil Field Operations was used to obtain data. The questionnaire comprised closed-ended questions on personal and work characteristics, types and kinds of accidents encountered in the last 12 months, the frequency of accidents suffered in the past 12 months, and compliance with safety practices. The instrument was subjected to content validation by academic supervisors along with two experienced HSE professionals, and then the unclear items in the instrument were reworded prior to the main survey. A pilot test was carried out with 20 oil field workers from other oil businesses not in the sample to check the understanding and consistency of the questionnaire, and Cronbach's alpha for evaluating accident frequency and compliance with safety practices was 0.81 and 0.88, respectively, which is above the minimum value adopted in the thesis.

2.4 Measurement of Variables

The types of common accidents were assessed using a checklist where the respondents were asked to tick whether they had an accident or not in the past year, and results were presented in frequencies and percentages. Accident frequency was measured using 5 statements ranging from 1 (Never) to 5 (Very Often) each for general accidents, hazardous exposure, minor accidents or near misses, major accidents, and perceived accident frequency reduction. Five statements rated on a scale of 1 = Never to 5 = Always were used to assess compliance, covering the following areas: use of required PPE, prompt reporting of hazards, following SOPs and work permits, following approved procedures, and taking part in safety meetings and toolbox talks. Accident frequency and compliance were converted to composite scores for the correlation analysis.

2.5 Data Collection and Analysis

Copies of the questionnaire were directly administered with the help of two trained research assistants, with the added assurance that respondents could report their experiences without the attachment of their name or staff identification numbers. The number of questionnaires distributed was 333, and the number of completed questionnaires that were delivered was 302, so the delivered questionnaire response rate was 90.7% (valid responses). Frequencies and percentages and mean scores were computed, and Pearson Product-Moment Correlation was used to test the stated null hypothesis at the 0.05 level of significance using IBM SPSS Version 27. The direction and magnitude of the coefficient were interpreted, but it was considered to be an association and not evidence that compliance alone led to a change in accident frequency.

3. RESULTS AND DISCUSSION

3.1 Profile of the Respondents

Respondents numbered 302 and had a high level of experience in the operation of the Respondent/CMMS software, which helped to interpret their responses to accidents and compliance practices. A total of 251 respondents (83.1%) were male, and 208 (68.9%) were in the age group of 26 to 40 years, indicating that the sample was mainly composed of adults who were active in operational positions. Post-secondary qualifications were widespread, with 139 (46.0%) of the respondents having an HND or a Bachelor's degree, while 93 (30.8%) of the respondents had an OND or NCE qualification. Most of the respondents were technicians (34.1%) and operators (27.2%), with the majority (70.1%) having been in the industry for a minimum of 6 years. Of 299 respondents, 239 (79.1%) reported they used rotational work; that is, most of the respondents had firsthand experience of continuous-production schedules and the safety requirements of the changing work periods.

3.2 Common Types of Operational Accidents

As indicated in Table 1, equipment and containment-related events dominated the reported accident pattern, as equipment failure or malfunction (70.2%), gas leak or exposure to fumes (61.3%), and oil spill or leakage (55.0%) were reported by 212, 185, and 166 respondents,

respectively. The top four accident categories among workers were found to be transportation accidents (38.4%), fire outbreaks/explosions (31.1%), falls from height (27.2%), and chemical exposure/burns (23.2%). These percentages are based on whether the respondents had each of these events within the past year; that is, a worker may have experienced more than one type of accident; thus, the percentages should not be combined to obtain an overall accident rate.

Table 1: Common Types of Operational Accidents Experienced in the Previous 12 Months

Accident type	Yes	%	No	%
Oil spill/leakage	166	55.0	136	45.0
Gas leak/fume exposure	185	61.3	117	38.7
Fire outbreak/explosion	94	31.1	208	68.9
Equipment failure/malfunction	212	70.2	90	29.8
Fall from height	82	27.2	220	72.8
Chemical exposure/burn	70	23.2	232	76.8
Transportation accident (land/marine)	116	38.4	186	61.6

Source: Field survey, 2025.

This highlights the growing prominence of equipment failure as one of the key causes, for which the burden of preventing related incidents falls not on the behaviour of the workers but on the integrity of the equipment they are expected to work on. Okirie *et al.* (2024) demonstrated that operational constraints, lack of resources, and technical capacity gaps are among the factors affecting maintenance decisions in industries in southern Nigeria that can negatively impact equipment reliability if these deviations do not have appropriate risk assessment. While the current result does not point to specific causes for any malfunctions, an experience rate of 70.2% should not be interpreted as evidence of a lack of maintenance in all incidents reported but is high enough to warrant an in-depth analysis of inspection schedules, preventive maintenance records, safety-critical equipment, and outstanding maintenance work in participating operations.

The next two positions, for gas leaks and oil spills, signify that loss of containment was another frequent event in the surveyed work environment, and not an exceptional emergency event. These can include corrosion, seal failure, damaged piping, isolation or operating error, and the resulting release depends on the product, ignition source, time, and speed of detection. Oil and gas fire and explosion risks should be systematically analysed considering the interaction of various failure modes (Aydin *et al.* 2022), which makes it necessary to consider leak events as a first step. Thus, the lower percentage (fire/explosion) of 31.1% is reassuring only in the relative sense, and a fire or explosion could happen less frequently and still require a higher level of attention due to its potential severity.

Transportation accidents received more frequent mention than chemical burns, fires, or falls, indicating that the risk of operations is not just related to stationary equipment involved in production. Al-Mekhlafi *et al.* (2021) demonstrated that positive safety-culture practices had a positive effect on the driving performance among oil and gas tanker drivers, indicating that the concepts of journey planning, supervision and individual behaviour are still relevant for transport safety. The present survey still did not distinguish between road or marine incidents or determine if fatigue, vehicle condition, weather, route quality, or driving behaviour was a factor; thus, its result should be interpreted as a call to action rather than as a statement of the causes of the incidents.

Falls from height and chemical exposures had the lowest percentages but were still found for nearly one-quarter of the respondents, indicating that such hazards don't simply disappear because it was more common to have equipment failures and releases. Benson *et al.* (2021) reported that oil and gas workers in Nigeria are generally exposed to physical and chemical risks; hence, a combination of engineering controls, safe access systems, ventilation, proper handling of chemicals, and wearing appropriate personal protective equipment (PPE) would be

useful in preventing exposure. A minor programme, focused only on the top three events, would result in a personal-safety issue not being covered sufficiently to result in a permanent injury, as a single fall or chemical burn might be sufficient.

3.3 Frequency of Operational Accidents

The results in Table 2 indicate that the reported operational risk is still at a moderate level, with the highest mean score being exposure to hazardous conditions (2.90) and minor incidents/nearmiss (2.89). The statement that yielded the highest mean was operational accidents, with a mean of 2.84, while the lowest mean of 2.36 was for major accidents. The mean for the respondents' evaluation of change in the number of accidents in the last twelve months was 2.68; this was below the midpoint of the scale (3.00), suggesting that on average the respondents did not believe that the number of accidents had decreased in the past year.

Table 2: Frequency of Operational Accidents in the Previous 12 Months

Statement	1	2	3	4	5	Mean
Operational accidents occur in my workplace	58 (19.2%)	46 (15.2%)	114 (37.7%)	54 (17.9%)	30 (9.9%)	2.84
Workers are frequently exposed to hazardous conditions	51 (16.9%)	50 (16.6%)	109 (36.1%)	62 (20.5%)	30 (9.9%)	2.90
Minor incidents/near-misses occur during operations	46 (15.2%)	67 (22.2%)	98 (32.5%)	57 (18.9%)	34 (11.3%)	2.89
Major accidents have occurred within the past year	102 (33.8%)	73 (24.2%)	64 (21.2%)	40 (13.2%)	23 (7.6%)	2.36
Accident frequency has reduced over the past year	61 (20.2%)	73 (24.2%)	98 (32.5%)	43 (14.2%)	27 (8.9%)	2.68

Source: Field survey, 2025. Response scale: 1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Very Often.

The small difference between exposure to hazardous conditions, near-misses, and general accidents indicates that the warning signs of failure were at least as apparent to workers on a daily basis as the actual accidents. This pattern is important because a workplace could continue to have unsafe conditions with weak controls and have no major loss for a while before only a major loss occurs, which could lead to a false sense of security. For this reason, IOGP (2025) keeps the process-safety event reporting stream separate from the incident stream.

The worst average was for major accidents, although it is important not to interpret the outcome of the indicator alone without taking into account the other indicators, as the working environment was not safe. Major events can happen infrequently, while equipment malfunction, gas exposure, and minor events can occur more often, as the impact of the major events is much greater. While regulatory focus and company investment are potential enablers to better HSE outcomes in petroleum operations, Acheampong and Kemp (2022) also revealed that the ageing of infrastructure and disruption of operations remain a challenge to HSE performance. The results of the present study thus indicate that a balanced strategy should be used in which everyday events are explored to facilitate learning, and high-consequence events should continue to be the subject of good emergency and barrier control.

When respondents were asked to rate their perception of accident frequency on the statement that Accident frequency has decreased, the mean of 2.68 did not verify that there had been a decrease, as respondents rated their perception at one point, and the study did not attempt to compare the number of accidents as reported over two equivalent periods. This is particularly significant at the smaller event level where there might be less consistent reporting. Ghahramani *et al.* (2025) identified fear of reporting, weak feedback, and a concern for the organisation's consequences as underreporting factors, as well as low-severity incidents and near-misses as factors often considered not to be worth reporting. Survey responses then would have to be validated with incident logs, near-miss records, maintenance data, and man-hours worked to be a reliable indicator of improvement in the selected companies.

3.4 Workers' Compliance with Safety Practices

There was good compliance across the five practices presented in Table 3, but minor areas of concern were identified based on the differences between the items. The highest mean was for required PPE use, at 4.11; followed by compliance with approved safety procedures, at 4.03, and participation in safety meetings and toolbox talks, at 3.96. Following SOPs and work permits yielded the highest mean of 3.91, with prompt reporting of unsafe conditions and hazards the lowest at 3.85. The mean scores for all were above 3.00; however, the lower score on reporting is important, as unreported conditions can still contribute to subsequent incidents.

Table 3: Workers' Compliance with Safety Practices

Statement	1	2	3	4	5	Mean
I always use the required PPE during operations	10 (3.3%)	20 (6.6%)	26 (8.6%)	122 (40.4%)	124 (41.1%)	4.11
I report unsafe conditions and hazards promptly	18 (6.0%)	28 (9.3%)	38 (12.6%)	116 (38.4%)	102 (33.8%)	3.85
I follow the SOPs and work permits during tasks	14 (4.6%)	24 (7.9%)	39 (12.9%)	125 (41.4%)	100 (33.1%)	3.91
I comply with approved safety procedures at all times	12 (4.0%)	26 (8.6%)	34 (11.3%)	118 (39.1%)	112 (37.1%)	4.03
I participate in safety meetings and toolbox talks	16 (5.3%)	34 (11.3%)	40 (13.2%)	118 (39.1%)	94 (31.1%)	3.96

Source: Field survey, 2025. Response scale: 1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always.

The high PPE score indicates that it is likely that the visible and personally controlled requirements were well established among the respondents, but not whether the PPE was always appropriate, properly fitted, and worn during all exposures. In many cases, PPE is the last line of defense and will not be the only line of defense against elimination, isolation, ventilation, or guarding, or reliable containment of the process. It is especially relevant to an accident pattern like that in Table 1, since workers could put on PPE and then run into frequent malfunctions of the tools or gas releases originating from the rest of the operating system.

Favourable ratings were also given for compliance with approved procedures and SOPs and work permits, indicating that formal controls were generally integrated into reported work routine. Compliance in oil and gas operations is closely related to safety supervision, workers' safety competence, and access to safety systems, as discovered by Benson *et al.* (2022). Such an influence is also apparent among the workers in the Niger Delta, as Safety Management practices have been linked to compliance (Ehiaguina *et al.*, 2024). The current scores are consistent with this body of evidence; however, they should not be accepted as absolute evidence of good practice since the responses were from workers describing their own behaviour, and self-report data may be impacted by recollection, fear of judgement, and pressure to come across as a good, responsible worker.

Hazard reporting is worthy of special mention as it received the lowest (but still not below the scale midpoint) compliance score with a mean of 3.85. However, unlike wearing PPE, reporting is reliant on a worker seeing that there is an issue; in addition, there must be confidence that the concern will be received equitably and be investigated and corrected. Ghahramani *et al.* (2025) show that reporting could be undermined if minor incidents are normalised, and if there is a lack of corrective feedback or a fear of negative consequences. The practical response should therefore make reporting simple, ensure employees are safe from retaliation, provide feedback on what has been done, and monitor whether repeat reports are closed within the agreed period.

Participation in toolbox talks and safety meetings yielded a mean of 3.96, indicating that there was a high level of occurrence of routine safety communication, but with no indication of the quality of the communication. While attendance is crucial for any effective briefing, the importance of communication, leadership, and employee involvement in influencing safety performance should not be overlooked, especially for upstream oil and gas activities, as noted

by Naji *et al.* (2026). A good toolbox talk should tie in with the job that's about to be done, situations to be aware of, job equipment, what has happened in the past, or stop work procedures.

3.5 Relationship Between Compliance and Accident Frequency

Pearson correlation was used to determine if the reported frequency of accidents in operations and workers' compliance with safety practices were significantly correlated. However, the correlation coefficient in Table 4 is moderately inverse (-0.410), and the probability value is less than 0.001, indicating that there is a statistically significant considerable negative relationship between the two composite measures. Thus, the null hypothesis was rejected as the results showed that those who scored high on compliance were more likely to score low on the reported accident-frequency score.

Table 4: Pearson Correlation Between Safety Compliance and Accident Frequency

Variables	CSP	FOA	p-value
Compliance with safety practices (CSP)	1.000	-0.410	<0.001
Frequency of operational accidents (FOA)	-0.410	1.000	<0.001

Source: Field survey, 2025.

The inverse relationship is also empirical evidence in favour of routine compliance being a factor considered a meaningful part of the prevention of accidents, as the workers who reported higher levels of adherence to PPE, procedures, permits, reporting, and safety meetings also tended to report fewer operational accidents. Similarly, Ajmal *et al.* (2022) came to the same conclusion in Malaysia's oil and gas industry, where the safety-management practices were linked with occupational accidents in terms of safety compliance. The present finding is also supported by findings from Ghana that safety-performance measures are influenced by multiple interrelated organizational and behavioral factors, not a single measure (Ofori *et al.*, 2023), thereby indicating a more integrated interpretation of the present finding.

The coefficient was -0.410 and significant but not sufficiently great to account for all of the accident pattern, and the preponderance of equipment failure in Table 1 clearly suggests caution. Even operators at work who are doing everything right can be overcome by the dangers of worn equipment, poor design or loss of containment, and vice versa. The conclusion therefore advocates a combined model of prevention that focuses on increased behavioural control as well as engineering integrity, maintenance, inspection and emergency preparedness, as opposed to a model that assigns responsibility for each occurrence to individual workers.

The overall trend is the same with other evidence from a high-risk setting, as Abegaz *et al.* (2025) revealed that the likelihood of self-reported injury was higher for workers in low safety conformity groups, after accounting for other factors. Bautista-Bernal *et al.* (2024) also provided evidence of the longitudinal relationship between safety culture and safety performance, further emphasising the need to focus on prevention throughout the year, and not just during a campaign. These studies add to the credibility of the current result but cannot eliminate the industry, country, measurement, and study design variation.

Given that this study was cross-sectional and both variables were obtained from a questionnaire, a correlation cannot be used to establish that increased compliance led to the decrease in accidents or that the same relationship would exist over time. However, there may be various reasons why the workers of lower-incident units had higher safety-system scores, or that unmeasured factors, such as equipment age, supervision, job type, and hours exposed to the job, contributed to both scores. A more thorough follow-up study would involve an integration of worker response with real incident records and the analysis of whether compliance (or lack of it) occurred before changes in accident rates for the same approximate periods of operation.

4. Conclusion

The evidence indicates the chosen onshore oil field activities had relatively high (reported) safety compliance aspects whilst also maintaining a consistent trend of operational hazards, such as equipment malfunction, gas/fume exposure and oil leakage. Low frequency events (major accidents) were reported less frequently than hazardous conditions (near-misses); however, this does not negate the necessity for good controls, as low frequency near-misses can have significant consequences. The area with the highest compliance mean was the use of PPE and compliance with approved procedures, while the lowest mean was for prompt reporting of unsafe conditions, suggesting that the preventive system was more visible in personal protective behaviour than in reporting of emerging unsafe conditions.

The large negative correlation between compliance and accidents illustrates that compliance is related to favourable operation results; the magnitude of the correlation is moderate, indicating that compliance is only one element in accident prevention. Safe behaviour cannot completely prevent hazards created by unreliable equipment, inadequate containment, lack of supervision, and poor maintenance and learning from near-misses; therefore, the actions expected from workers must be accompanied by their support. The findings should thus inform practical improvement, and not be interpreted as evidence of an accident reduction effect of compliance.

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