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Proactive Safety Behavior in Iraq's Oil Sector: Organizational Predictors, Near-Miss Reporting, and Hazard Exposure

Mohammed N. Azeez[1*], Kasim A. Alomari[2]

[1] Department of Construction and Projects, University of Technology, Baghdad 10066, Iraq
[2] Department of Civil Engineering, College of Engineering, University of Thi-Qar, Nasiriyah 64001, Iraq

Corresponding Author Email: mohammed.n.azeez@uotechnology.edu.iq

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ABSTRACT

This study examines proactive safety behavior in Iraq's oil sector by focusing on near-miss reporting, organizational predictors, and hazard exposure. It identified whether differences in hazard exposure translate into differences in reporting behaviors and perceptions of safety culture. A cross-sectional survey was used. The survey forms were passed to personnel of several oil operating companies operating in Iraq. 162 valid forms were analyzed. The instrument collect data on the respondents' perceptions of management responsiveness, safety culture, empowerment (including stop-work authority), self-reported hazard exposure and toolbox talk participation. Results showed no statistically significant difference in inclusive safety-culture ratings across organizational roles. The reporting-and-follow-up status was significantly associated with management responsiveness, stop-work authority, and toolbox talk attendance. Management responsiveness was the dominant predictor followed by the stop-work authority and toolbox talk participation. Respondents reported different categories of workplace hazards. The findings highlight practical levers for improving Iraq's oil industry. These are: enhancing visible follow-up of concerns, protecting and normalizing stop work authority, and embedding toolbox talk as part of the routine work. Feedback loops illustrating how reporting system catalyzes change should be incorporated into such discussions. The study provides country-specific data on reporting/learning systems in a rapidly changing context of oil production.

1. INTRODUCTION

Failures are not common in the oil industry, but they can be catastrophic if they do happen. Oil and gas industry operations have complex processes, high pressure systems and flammable materials. Thus, in such settings, safety culture is defined by the values and practices of everyday life that affect the recognition and response to early warnings.

Recent studies indicate that practices of empowerment, leadership, and the reporting system design contribute to the actual state of safety culture. The design of these systems is to learn from 'near misses' instead of responding to serious harm after the fact [1-3]. Safety culture can be understood as an operational variable which can be cultivated through everyday practice. Maturity models indicate that safety culture's most consistent signals are those of supervisors and workers during normal operation [1, 4]. Behavior at the job site starts to change when leaders follow up, view concerns as alerts to take action, and embed participation in the way things are done. Results from oil field environments support a connection between visible leadership and worker involvement with improved safety behaviors [5]. There are psychosocial hazards also: fatigue, stress and lack of support can cause a person to make mistakes, even when they know the hazards [6]. These pressures are more pronounced in developing countries where safety systems are inadequately enforced, lack resources and poor reporting practices are observed [7]. Safety performance in high-risk oil and gas operations relies on the ability to detect early warning signs, to report them, and to respond to them by empowering, leading, and follow-up [1-3, 8].

Iraq's oil industry since 2003 has been expected to be the backbone of public sector and economic recovery, thus safety performance has been taken as a national as well as operational issue. But fast growth can occur faster than the establishment of stable HSE systems. The oil sector in Iraq has been characterized as being exposed to occupational events associated with poor institutional safety standards and security instability [9]. Safety culture in this context is defined as the collective values, beliefs and practices of a workplace relating to safety [10]. The strong sense of safety culture is felt when people are taken seriously and respected within this culture [11]. The concept of safety-culture has been extended to a range of industries and national settings due to an increasing interest in practices of organizations and in workplace safety issues [12]. Yet the ability for reporting systems to facilitate open dialogue and proper follow-up is a significant concern when it comes to oil-sector operations in Iraq. Therefore, near-miss reporting is a useful test of whether a system is genuinely proactive. If near misses are to be integrated into the safety learning cycle, staff must be confident that reporting is safe,

that reports are fairly considered, and that appropriate action is taken as a result of the report [13-15]. Visible, consistent and responsive upper-management actions are practical design elements for safer operations [16]. This study fills this gap by studying proactive safety behavior in Iraq's oil sector based on perceptions about safety culture, near-miss reporting, organizational predictors, and hazard exposure. The analysis focuses on three research questions:

RQ1: Do perceived safety-culture ratings differ across organizational roles in Iraq's oil sector?

RQ2: Which organizational conditions are associated with near-miss reporting-and-follow-up status?

RQ3: Are reported hazard categories associated with perceived safety-culture ratings and near-miss reporting-and-follow-up status?

These questions link together perceptions of safety, reporting practices, and hazard exposure and outline practical approaches for enhancing proactive safety reporting in the context of Iraq's oil industry.

2. LITERATURE REVIEW

Research on safety culture has expanded rapidly and consistently emphasized that safety is reflected in everyday work practices. Safety climate is defined as shared perceptions of the understanding and importance of safety in an organization [17]. Accidents often arise from organizational weaknesses that may remain undetected for long periods and contribute to frontline failures [18]. Safety culture has been linked to behavior and attitudes [19] and described as progressing through stages of maturity from denial to learning [20]. Rigid rules can limit dialogue and make it harder for workers to adapt their practices [21]. Taken together, these studies suggest that effective safety practice depends on how formal procedures are applied in daily work.

Safety culture is more than a value for high hazard industries. This is evident in the oil and gas industry, where the work can involve multiple contractors, complex systems, tight timelines, and safety hazards that can turn critical in no time. There are several recent studies that focus on worker voice, visible leadership, learning routines, and empowerment in the day-to-day, when it comes to safety culture.

A number of studies have highlighted the importance of social dynamics in the development of safety culture, particularly learning behavior and psychological safety. Improving safety outcomes depends on the worker's ability to challenge unsafe decisions, stop work without fear, and speak up [22, 23]. Follow-up is a key component of a near-miss system of organization. Yamamoto et al. [24] found that inadequate responses to near-miss reports were associated with higher turnover intentions among workers, highlighting the importance of appropriate organizational responses. Policies that focus on safety but actions that focus on production can lead to a lack of confidence in safety management. There are relevant studies on organizational safety practices and accident underreporting that provide some context to this concern [25]. Multinational operations present another dimension as norms of authority and speaking up differ from culture to culture, which impacts on learning opportunities and problems to avoid, in the case of near misses [26].

Oil and gas work is often conducted in the presence of significant hazards and under the pressure of delivering the outputs safely [27, 28]. In these situations, supervisors' conflicting messages may decrease the rate of reporting and participation, since employees are not always clear about expected behavior from shift to shift [29]. Shared priorities can be reinforced through toolbox talks and participating in toolbox talks has been associated with increased hazard awareness and engagement in reporting [30]. Results of oil-and-gas operations in other national settings also suggest that organizational conditions are important. For example, Djunaidi et al. [31] documented changes in workers' safety-climate perceptions during an ownership transition in Indonesia. There are other studies that explored the relationship between organizational practices and safety management in oil and gas operations [32].

Role related differences are prevalent based on the information received at each role. Frontline workers frequently assess safety based on the speed of work, equipment condition, supervisor response and the rate at which hazards are dealt with [33]. The same environment might be perceived differently by HSE professionals who are looking to test controls and find gaps in systems [34]. Managers might report more positive perceptions because they are more involved in the development of policies than actual exposure to hazards [35]. These differences are not inherently problematic, but they become problematic when the perspectives of one group are regarded as over-exaggerated or misunderstood.

Proactive safety is all about near-miss learning, recognizing that "near-miss" can be a precursor to "no-incident". However, the negative feedback, fear of blame and uncertainty about responses from management can suppress reporting [36]. Management follow-up is an integral component of the near miss learning process. Failure to respond to issues at the organizational level can lead to a lack of trust in the reporting process, whereas adequate response activity and follow-up can instill trust in the process that concerns are being followed up [24]. Toolbox talks are also a part of the learning cycle and are intended to maintain the normalcy of hazard discussion [31]. Empowerment, particularly stop work authority, helps to reinforce the concept of safety in practice, not just in policy [37]. Consistent and visible leadership behaviors also provide evidence of their positive impact on participation, voicing issues, and safety engagement [16].

A site-specific element is added to the analysis through hazard perception. Task and location-specific risk profiles vary between processing facilities and maintenance and construction tasks: gas leaks, pressure systems, fire and explosion risks are more associated with processing facilities, whereas working at height, dropped objects, and electrical hazards are more associated with maintenance and construction. Heat stress is a frequent danger in desert operations, and impacts decision quality and fatigue as well [38]. This variation helps to explain the following observation: High hazard exposure does not necessarily result in better perceptions of safety or reporting. Organizational responses such as follow-up, consistency of leadership and communication quality, continue to be a stronger determinant of behavior.

2.1 Point of departure

Although the oil sector is an important player in the global energy system, empirical research on the safety culture of the oil industry in Iraq is limited. Much of the current studies focus

on technical hazards and engineering controls. This focus is warranted but can be misleading in terms of what happens when a challenge is made to the organization. The likelihood that the near miss will be seen as useful input rather than ignored depends on the workers' confidence that raising concerns won't have any negative consequences, as well as leadership response and follow-up [24, 36]. Indeed, basic safety awareness has been observed in Iraq, but the application of structured risk-management tools and safety procedures is not consistent across teams and sites, as illustrated by the evidence [39]. This is a potential source for significant differences to emerge as the operation becomes more complex, putting additional pressure on supervision and hazard management at contractors and shifts. Reporting can be compromised by layered contracting, multi-skilled workforce, tough environments, and production pressure, as well as aging infrastructure [31, 32]. Research in other settings indicates that leadership behavior, reporting practices and empowerment are linked to safety outcomes, and evidence in Iraq is limited. This means a sector-specific analysis of the working characteristics of these relationships across worksites and roles is required [23, 33]. Hence, this study investigates whether the mechanisms are relevant in the context of Iraq's oil sector, and whether local conditions have an impact on reporting, learning, and prevention that is different from what is reported elsewhere.

3. METHODOLOGY

This study used a survey-based, quantitative, cross-sectional approach to examine proactive safety behavior in Iraq's oil sector. The analysis focused on the perceived safety-culture ratings by organizational role, the relationship of management responsiveness, stop-work authority, and attendance at toolbox talks to near-miss reporting and follow-up status, and the relationship of reported hazard categories with safety-culture ratings and the reporting and follow-up status. These variables were selected because they can be linked to the organizational predictors of reporting and daily safety behavior, and are supported by previous literature [6, 9, 11, 40]. The research process is summarized in Figure 1 and involves instrument development, data collection, statistical testing, and interpretation. The study population comprised employees working in production, safety-related work and maintenance activities in the oil operating companies in the southern and central parts of Iraq. Purposive sampling technique was used to include front line workers, supervisors, HSE personnel, and management staff. The survey was sent out by hand and electronically, depending on site requirements (connectivity, administrative process, and device access). The participation was voluntary and anonymous because several items addressed reporting and speaking up. The survey covered elements of communication routines, leadership's responsiveness, empowerment, stop-work authority, near-miss reporting and hazard exposure. The instrument was designed in Arabic language using the same terms used in the workplace, to avoid misinterpretation between different groups of workers. A questionnaire was reviewed by academic experts and senior HSE practitioners in order to evaluate the relevance, clarity, and appropriateness of the items in the questionnaire for the context of the oil sector in Iraq. The items were evaluated by academic reviewers and senior practitioners in the HSE field to determine whether they measured the intended constructs, were applicable to the Iraqi oil-sector context, and were written in a clear manner. The pilot survey was carried out with eight respondents to determine the clarity of the questions and possible difficulties in completing the questionnaire. Minor changes were made before full distribution. The questionnaire was divided into six sections: Respondent characteristics and worksite information; Safety culture awareness and management attention to safety concerns; Safety practices, stop-work authority, toolbox talk participation, and near-miss reporting; Safety training and digital safety tools; Management responsiveness and support to report safety concerns and suggestions for improvement; Open-ended questions to solicit responses on work site hazards and suggestions for improvement.

The completed questionnaires were coded in a uniform manner prior to statistical analysis. As for years of experience, they were grouped into either 10 years or less, or 10 years or more based on respondents' recorded years of experience. Ordinal and categorical responses were recoded as numeric values and reported hazards were categorized into the 6 categories of hazard exposure: process/chemical, physical/mechanical, environmental, mixed, other, and unspecified. Safety culture was measured as an ordered score from 1 to 4: weak/reactive, needs improvement, generally good, and strong/proactive. This measure represents a single-item assessment of respondents' overall perceptions of safety culture. It was not a measure of individual aspects of organizational safety culture nor a validated multidimensional scale. Thus, the results are presented in terms of perceived safety-culture ratings. In order to perform inferential analysis, the key predictors were entered as ordered levels to indicate a progressive change in observation instead of a simple yes/no comparison. The management responsiveness was categorized into three ordered levels: low, moderate and high. The regression predictor was based on detailed management-responsiveness item in which role-specific wording was used. This question was independent of the four-category question on whether safety concerns were taken seriously. Three respondents with contradictory multiple selections were excluded from the regression analysis, leaving 159 valid cases. One person who responded positively in two categories was placed in the high responsiveness group. The stop-work authority was classified as none, sometimes or full authority. Toolbox talk participation was coded as non-attendance, sometimes, weekly, or daily. The three predictors were treated as ordered scores in the main logistic regression. This specification assumes a constant change in log-odds between adjacent response categories, although the categories do not necessarily represent equal intervals. An alternative model treating the predictor categories separately was examined to assess this assumption. Variance inflation factors were used to check for multicollinearity. Near-miss reporting was dichotomized as Yes, meaning reported and followed up appropriately, versus No, including sometimes, rarely, or unsure, to support clear logistic-regression interpretation. The questionnaire item combined near-miss reporting with appropriate organizational follow-up. As such, the dependent variable was then interpreted as the reporting and follow-up status instead of reporting behavior alone. Open-ended hazard responses were coded into exposure categories using keyword-based rules. The dataset was checked for missing data and non-standard entries. A descriptive analysis of all 162 respondents was conducted. Three respondents were excluded from analyses involving the detailed management-responsiveness

item due to multiple, contradictory responses on that item. Thus, a modified logistic regression was carried out with 159 respondents. Analyses that did not require this variable retained the available valid responses.

Descriptive and inferential analyses were used. Descriptive statistics summarized responsiveness, safety culture, empowerment, toolbox talks, reporting, and hazard exposure. For RQ1, role-group differences in safety culture ratings were tested using the Kruskal–Wallis procedure, with epsilon-squared (ε^2) used as the effect size. For RQ2, bivariate associations between near-miss reporting and each predictor were tested using chi-square tests and Cramer's V. A binary logistic regression model then assessed the adjusted contributions of management responsiveness, stop-work authority, and toolbox talk participation to near-miss reporting, with effects reported as odds ratios and 95% confidence intervals. For RQ3, hazard exposure groups were compared on safety culture ratings using Kruskal–Wallis with ε^2, and their association with near-miss reporting was tested using chi-square tests.

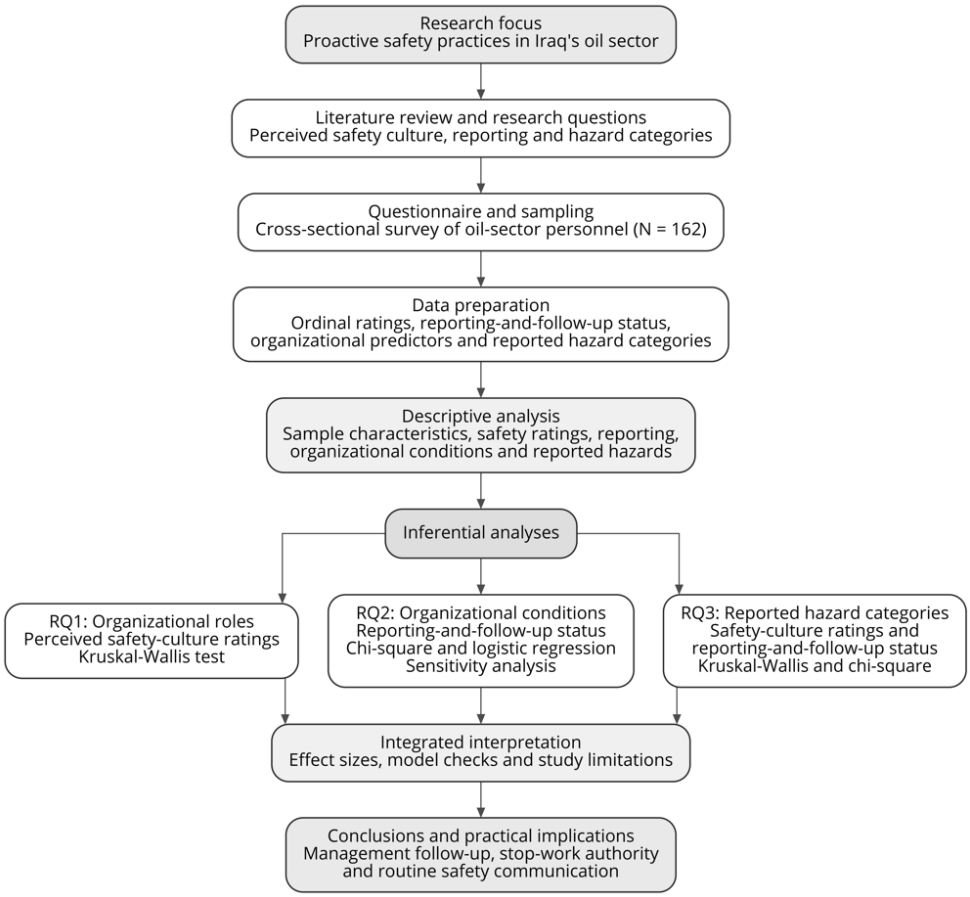

Figure 1. Research workflow showing questionnaire development, data preparation, descriptive and inferential analyses, and integration of the three research questions

4. RESULTS

4.1 Respondents descriptive statistics

The analysis included 162 valid responses. Table 1 presents the respondents' role, experience, and worksite context. The largest number of employees who participated were frontline workers, followed by management employees and HSE professionals, meaning that the analysis could include the opinions of operational, supervisory, and safety-specialist employees. The majority of the respondents were very experienced, having had ten years' experience or more (68.5%). Respondents also represented various work settings, primarily processing facilities, office or administrative jobs, field operations and maintenance, and drilling operations. The findings from the main descriptive patterns of: Safety Culture, empowerment, responsiveness, Toolbox Talk participation, near-miss reporting and Hazard exposure are presented in the next section.

Table 1. The characteristics of the respondents (N = 162)

Variable	Category	Percent (%)
Type of Role (Position)	Frontline Personnel	65.4
	Management Personnel	24.1
	HSE Professionals	10.5
Years of Experience	<10 Years	31.5
	≥10 Years	68.5
Type of Workplace Environment	Processing Facilities	40.1
	Office / Administrative	29.6
	Field Operations / Maintenance	28.4
	Drilling Operations	1.9

4.2 Descriptive statistics of safety culture and reporting behaviors

The answers do not indicate a standardization of a "safety culture" among the surveyed oil operations. Table 2 displays variation in safety culture, responsiveness, empowerment,

toolbox talk participation and near-miss reporting. The largest group of respondents (45.7%) rated safety culture as generally good, while 34.0% indicated that improvement was needed. A smaller number (12.3%) reported it to be strong and proactive, and another smaller number (8.0%) reported it to be weak and reactive. The findings suggest that perceived safety culture varies among the surveyed respondents. The general assessment was adequate, but there was a variation in maturity and levels of baseline commitment. Management responsiveness was rated more favorably and had less variation. The majority of respondents said that safety concerns are addressed seriously, but a minority said that follow-up is either weak or nonexistent. This is still relevant because failing to provide follow-up can make it feel futile to report and over time diminish reporting practices.

The perception of authority to stop unsafe work was somewhat mixed. Some respondents indicated they had full authority, some indicated they had authority in certain situations, and some did not indicate that they had authority. This gap is not only due to policy, but also to the extent to which workers feel protected when attempting to stop unsafe jobs. There was also variation in toolbox talk participation which indicates that toolbox talks are in existence but not yet standard practice. This is significant as toolbox talks are one of the easiest ways to keep discussing and emphasizing hazards, and keeping expectations visible before starting work. There was moderate engagement with near-miss reporting, which was not consistent. The system exists and sometimes operates, but there is likely to be a problem of follow-up and feedback which may account for the unreliability of the reporting.

Table 2. The perceptions of the sample size (N = 162) about toolbox talk participation, empowerment, safety culture, management responsiveness, and reporting practices

Variable	Response Sort	Percent (%)
Perception of Safety Culture	Strong and proactive	12.3
	Generally good	45.7
	Needs improvement	34
	Weak / reactive	8
Concerns Taken Seriously	Always	64.8
	Sometimes	29
	Rarely	4.3
	Never	1.9
Authority to Stop Unsafe Work	Yes	50.6
	Sometimes	20.4
	No	29
Toolbox Talk Attendance	Daily	9.9
	Weekly	18.5
	Sometimes	52.5
	I do not attend	19.1
Near-Miss Reporting	Yes (always)	58.6
	Sometimes	20.4
	Rarely	11.1
	Not sure	9.9

4.3 Hazard perception categorization

The primary categories of hazard reported by respondents are shown in Figure 2. The profile is not constrained to a particular type of risk; it also covers process risks and task-related risks. The most common category was "gas and chemical hazards" and examples were concrete and not abstract. These included exposure to H_2S, repeated emissions, hydrocarbon leak, and pipeline or pressurized line issues. Machinery, equipment and lifting hazards were closely behind, primarily due to heavy lifts, mechanical failures, cranes, rotating machinery and unexpected material movement. The second cluster was related to explosion and fire hazards, relating to ignition sources, hot work, and being able to respond to rapidly changing conditions.

Other hazards were less commonly reported but still present, such as PPE issues, behavioral safety issues, electrical hazards, maintenance hazards, temporary connections, and tasks that were performed under a partially or fully operating system. These lower frequencies are also important as low frequencies are not equal to low consequences in the oil industry. Reporting was lower for working at height, environmental exposure, failure of permits to work and vehicle movement, but was still regarded as important as it can turn into a high consequence hazard if controls are not maintained. A small number reported no hazard and a minor subset reported very vague responses, not easily categorized. In general, hazard perception was spread across several categories, with gas/chemical hazards, equipment and lifting hazards and explosion or fire hazards being the dominant clusters.

Descriptive results provide the major trends of responsiveness, safety culture, empowerment, toolbox talk, near-miss reporting and hazard exposure. However, frequencies cannot reveal differences in perceptions between role groups, and cannot reveal associations between organizational conditions and reporting behavior. Thus, the inferential results of RQ1, RQ2, and RQ3 are presented next. A summary of the principal tests and models is given in Table 3.

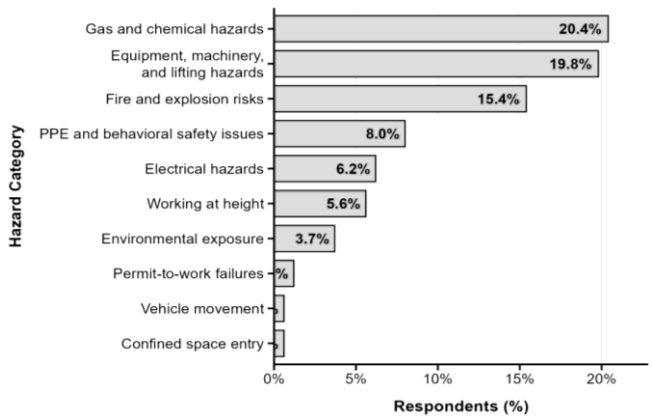

Figure 2. The distribution of reported hazard categories across the surveyed worksites in the oil sector (N = 162)

4.4 Role-based differences in safety culture perceptions (RQ1)

The first research question (RQ1) explored if the perceived safety-culture rating varied by organizational role. In oil operations, role can affect what workers see, control, and report. Safety culture perception was measured on a four-level ordinal scale ranging from weak/reactive to strong/proactive. Safety culture perceptions were compared across three role groups using the Kruskal–Wallis H test, with epsilon-squared (ε^2) used to assess effect size. There was no statistically significant difference between the perception of safety culture across roles ($H = 3.78$, $p = 0.151$), with a small effect size ($\varepsilon^2 = 0.014$). This indicates that only a small amount of the differences in safety culture ratings could be attributed to role.

Table 3. The results of the inferential analysis for answering the study's questions (RQ1, RQ2, and RQ3)

Research Question	Test	Variables Examined	Key Result	Effect Size	Interpretation
RQ1: Do perceived safety-culture ratings differ across organizational roles?	Kruskal–Wallis	Role group × perceived safety-culture rating (single item; four levels)	H = 3.78, p = 0.151	$\varepsilon^2 = 0.014$	No statistically significant role-based difference detected. Does not establish equivalence across groups.
RQ2: Which organizational conditions are associated with reporting-and-follow-up status?	Binary logistic regression; bivariate χ^2 tests	Management responsiveness; stop-work authority; toolbox-talk attendance → reporting-and-follow-up status (Yes vs other answers)	OR = 3.26 (responsiveness); OR = 1.77 (stop-work authority); OR = 1.73 (toolbox talks). Main-model p values: < 0.001, 0.014, 0.035, respectively.	LR $\chi^2(3) = 47.97$; p < 0.001; McFadden $R^2 = 0.222$; AIC = 176.50; N = 159	All three associations are positive in the main model. Toolbox-talk attendance is nonsignificant after excluding "Not sure" (p = 0.169). Outcome combines reporting and follow-up.
RQ3: Are reported hazard categories associated with safety-culture ratings and reporting-and-follow-up status?	Kruskal–Wallis; χ^2 test	Hazard category × safety-culture rating; hazard category × reporting-and-follow-up status	Safety-culture rating: H = 12.32, p = 0.031. Reporting status: $\chi^2(5) = 2.27$, p = 0.810.	Safety-culture rating: $\varepsilon^2 = 0.047$. Reporting status: Cramer's V = 0.118	Small difference in ratings across hazard categories; no significant association with reporting-and-follow-up status detected.

No statistically significant differences were found between the three organizational roles in perceived safety-culture rating. This result does not establish that the groups experience the same organizational safety culture. This might be a reflection of common organizational routines, common programs for safety, or comparable level of leadership signals, not only exposure to a specific role. The prevalence of perceived safety culture was not significantly different by role, suggesting that reporting near misses may be a better measure of proactive safety practice. Therefore, the next analysis focused on the organizational factors that predict reporting of near-miss events.

4.5 Indicators of near-miss reporting: Responsiveness, toolbox talks and empowerment (RQ2)

The second research question (RQ2) examined the associations between management responsiveness, stop-work authority, toolbox talk attendance, and near-miss reporting-and-follow-up status. Near-miss reporting was coded as Yes or No, with sometimes, rarely, and unsure grouped as No. Three operational predictors were tested: management responsiveness, stop-work authority, and toolbox talk participation.

Chi-square tests were initially conducted to assess the associations, and binary logistic regression was employed to further analyze the associations. Of the 162 respondents, three were omitted due to contradictory multiple responses for management responsiveness; this reduced the number of respondents used in the regression analysis to 159. None of the respondents were excluded based on the "Not sure" answer for near-miss reporting in the main model.

The bivariate analyses showed significant associations between reporting-and-follow-up status and management responsiveness ($\chi^2(2) = 32.80$, $p < 0.001$, Cramer's V = 0.454), stop-work authority ($\chi^2(2) = 26.77$, $p < 0.001$, V = 0.410), and toolbox talk attendance ($\chi^2(3) = 18.62$, $p < 0.001$, V = 0.342). All three analyses included 159 respondents. The binary logistic regression model was statistically significant (LR $\chi^2(3) = 47.97$, $p < 0.001$; McFadden $R^2 = 0.222$; AIC = 176.50; N = 159). Management responsiveness showed the strongest adjusted association with reporting-and-follow-up status (OR = 3.26, 95% CI 1.68–6.33, $p < 0.001$), followed by stop-work authority (OR = 1.77, 95% CI 1.12–2.79, p = 0.014) and toolbox talk attendance (OR = 1.73, 95% CI 1.04–2.86, p = 0.035). The bivariate and adjusted results are presented in Tables 4 and 5, respectively.

A sensitivity analysis was also conducted after excluding the 16 respondents who selected "Not sure" for near-miss reporting. 143 respondents with usable predictor responses were retained for analysis. Management responsiveness and stop-work authority continued to be statistically significant and toolbox talk attendance was no longer significant (p = 0.169). These findings suggest that the first two associations were more stable under the alternative outcome coding. Multicollinearity was assessed and had low variance inflation factors (1.18-1.34). An alternative model treating the predictor categories separately also showed a significant overall association with reporting-and-follow-up status (LR $\chi^2(7) = 49.83$, $p < 0.001$). However, estimates for individual categories were less accurate. The ordinal-score model had a lower AIC (176.50 versus 182.64), and was therefore used as a simpler representation of the observed associations.

Prior to the adjustment, all the bivariate patterns are consistent; there is a moderate association between responsiveness, empowerment, and toolbox talk participation and near-miss reporting. However, bivariate tests cannot show whether one variable is simply acting as a proxy for another.

This limitation is addressed in Table 5, which estimates the independent effect of each predictor after accounting for the other predictors. This is a practical question: Does responsiveness continue to be a predictor of reporting after empowerment and communication practices are taken into account? This aligns with process-safety literature, where reporting becomes preventive only when it is trusted, acted upon, and safe to use in real hierarchies [3, 8].

RQ3 shifted the focus from organizational predictors to hazard exposure, examining whether hazard profiles align with safety culture ratings and near-miss reporting.

4.6 Hazard categories, perceived safety-culture ratings and reporting-and-follow-up status (RQ3)

RQ3 was focused on determining if there was a relationship between respondent-reported hazard exposure and safety culture ratings or near-miss reporting. A small sub-group reported no clear hazard, which may reflect genuine low exposure levels, or under-recognition, thus caution should be exercised in interpreting this finding. Open-ended hazard descriptions were coded into six exposure categories: physical/mechanical, process/chemical, environmental, mixed, other, and unspecified. There was a statistically detectable difference between safety culture ratings across hazard groups (Kruskal–Wallis H = 12.32, p = 0.031), but the effect size was small (ε2 = 0.047). Table 6 shows the median safety culture score and percentage of respondents that reported a near miss for each of the six hazard exposure groups.

The process/chemical group tended to rank lower on the safety-culture scale, while most other groups clustered around a median of 3. Near-miss reporting did not differ significantly across hazard groups ($\chi^2(5) = 2.27$, p = 0.810; Cramer's V = 0.118). The results show a weak relationship between the hazard category reported and the perceived safety-culture ratings. However, in this sample no statistically significant association was found between hazard category and reporting-and-follow-up status. This does not rule out the possibility of an association in another larger, differently-distributed sample. Some hazard categories contained relatively few respondents, particularly the environmental group (n = 8). Thus, caution should be used when interpreting group medians.

Table 4. Bivariate χ^2 checks used alongside RQ2 modeling

Predictor	χ^2	df	P	Cramer's V	N
Management responsiveness (3 levels) × near-miss reporting status	32.80	2	<0.001	0.454	159
Stop-work authority (3 levels) × near-miss reporting status	26.77	2	<0.001	0.410	159
Toolbox talk attendance (4 levels) × near-miss reporting status	18.62	3	<0.001	0.342	159

Note: Near-miss reporting status was coded as Yes = reported and followed up appropriately; No = sometimes, rarely, or unsure.

Table 5. Results of the binary logistic regression for near-miss reporting (RQ2)

Predictor	B	SE	OR	95% CI (OR)	p
Management responsiveness (per level increase)	1.182	0.339	3.26	1.68–6.33	<0.001
Stop-work authority / empowerment (per level increase)	0.570	0.232	1.77	1.12–2.79	0.014
Toolbox talk attendance (per level increase)	0.546	0.258	1.73	1.04–2.86	0.035

Table 6. Differences in safety culture perceptions and near-miss reporting across hazard exposure group (RQ3)

Hazard Exposure Group	N	Safety Culture Score, Median	Near-Miss Reporting (Yes), %
Physical / mechanical	41	3 (2–3)	58.5
Process / chemical	38	2 (2–3)	60.5
Other	34	3 (2–3)	55.9
Mixed	24	3 (2–3)	66.7
Unspecified	17	3 (3–3)	58.8
Environmental	8	3 (2–3)	37.5

5. DISCUSSION

The results suggest that safety in the surveyed organizations is more a function of the credibility of organizational response than job role. The descriptive results indicated a lack of uniformity with daily practice, particularly in the areas of participation in toolbox talk, empowerment, and hazard recognition. The inferential results made the pattern clearer. Near-miss reporting was most strongly linked to management responsiveness, followed by stop-work authority and participation in toolbox talks. Role-based differences in perceived safety culture were not statistically significant, and hazard category showed only a small association with safety culture ratings. This implies that reporting culture is more dependent on the organization's conditions than on the kind of work or the level of hazard, a typical safety climate perspective that states that workers do not react to formalized statements, but rather to repeated actions [17].

5.1 Role-based differences in safety culture perceptions (RQ1)

RQ1 investigated whether there were role differences in safety culture perceptions. There was no statistically significant difference by role and the effect size was found to be minor. The lack of statistical significance reflects that the survey did not reveal a distinct difference across the various roles with respect to overall safety culture ratings. However, it is not possible to conclude from a single item whether different organizational roles have similar underlying norms, practices or experiences with safety. One argument is that numerous safety signals are felt all at once such as production pressure, reporting avenues, supervision norms, and HSE messaging. Care needs to be taken regarding this convergence. It does not indicate high-quality implementation across the board; it can also imply that strengths and weaknesses are widely felt throughout groups.

5.2 Indicators of near-miss reporting: Responsiveness, toolbox talks and empowerment (RQ2)

The most prominent behavioral indicator from the study was identified in RQ2. Near-miss reporting was most strongly associated with management responsiveness, followed by empowerment and toolbox talk attendance. This pattern makes sense because reporting is an intentional activity which has to

be performed with effort and, in some environments, a perceived risk. If follow-up is seen as visible and predictable then reporting becomes valuable. If there is little follow-up or it's underwhelming, perhaps there is a greater sense of safety or ease in silence. The same goes for the authority to stop work. If this authority is practiced, then intervention and reporting become commonplace and if it is conditional, then intervention and reporting can be selective. This suggests that such a rise in reporting without improving follow-up and protection systems is unlikely to lead to lasting change. Organizational follow-up was also included in the reporting outcome, and can overlap with the management responsiveness predictor. This overlap may have helped to reinforce the association observed. The findings should therefore be interpreted as relationships between organizational safety measures and reporting-and-follow-up status, rather than evidence of an independent causal effect on reporting behavior. The regression also assumed a constant change in log-odds between adjacent predictor categories. Since the response categories do not necessarily represent equal intervals, the odds ratios should be interpreted as average category-level associations. Furthermore, the company identifiers were not available and no assessment of potential clustering of responses in operating companies could be made. When interpreting the precision and overall applicability of the estimates, these limitations should also be taken into account.

5.3 Reported hazard categories, safety-culture ratings, and reporting-and-follow-up status (RQ3)

RQ3 investigated relationships between hazard environments and safety culture perceptions and reporting patterns. Respondents identified a variety of hazards and safety culture ratings were slightly varied by hazard group. But the reporting trends across the categories were largely comparable. No statistically significant association was detected between reported hazard category and reporting-and-follow-up status. But this does not indicate that exposure to hazard does not have any influence on reporting practices. Hazards dictate exposure, and empowerment, leadership follow-up and communication routines dictate the defense and learning loop. Hence, interventions targeting only hazard-specific training could be failing to address the more comprehensive driver if responses are not consistent. Additionally, recent examples of upper-management actions shed further light on the need for visible and repeatable management actions to enhance safety [16].

Overall, the results indicate that proactive safety behavior is influenced primarily by consistently responding to the hazard and granting protected stop-work authority, and by the regular communication on safety issues with feedback loops.

5.4 Practical implications

Results are consistent with safety culture theory, which suggests that the likelihood of safety systems being “in use” is driven by the way leadership behaves, by the level of trust, and by the worker agency. The regression resulted in the identification of relationships between organizational conditions and reporting-and-follow-up status. Role based safety-culture ratings and hazard-category associations were analyzed individually. The findings are consistent with the role of organizational response in safety management. Previous research has also linked inadequate responses to near-miss reports with unfavorable worker outcomes [24]. but the present cross-sectional analysis cannot determine the directions of these relationships. Regional importance in the oil and gas sector of Iraq, where a combination of workforces, fast operations and sub-contracting layers can cause a decrease in accountability and an increased demand for supervision. Reporting culture thus becomes a viable measurement of quality of safety-governance. Managerial and procedural are the most relevant improvement mechanisms: protected stop work authority, consistent follow up, and the regular communication to close the feedback loop following the report. Although no statistically significant differences between roles were found, this does not rule out differences in perceived safety or practices between organizational levels.

Primary, it is necessary to see and have trust in management responsiveness. Therefore, corrective actions must be timely, traceable and communicated back to the individuals who raised the concern. It is the consistency that is the most important point. Frequent reminders of the consequences of reporting improve trust and reporting becomes part of the job, not a risky proposition. Second, empowerment should not be limited to a written policy but should be an operational control safeguarded. Supervisors play an integral role in enforcing stop-work and if not, workers can be selective in reporting or intervening. Third, it is important for safety communication to be reinforced through regular toolbox talk sessions, repeated on worksites, with feedback loops and a true non-punitive reporting culture [30]. Finally, hazard recognition support needs to be targeted and practical, particularly for respondents who indicated that they did not see any hazards. These might stem from reduced exposure, lower hazard awareness or a lack of regular hazard discussion. This also corroborates the engineering-safety research indicating that hazard identification and risk-source recognition are crucial parts of risk assessment in complex systems [41]. Maintaining the practice of recognizing and reporting hazards is important to support learning and reporting. The more consistent the follow through, the more active the worker, and the more even the communication patterns, the more improved the situation will be.

6. CONCLUSION

In this study, perceived safety-culture ratings, organizational conditions associated with near-miss reporting-and-follow-up status, and the reported hazard categories in the oil sector in Iraq were examined. The clear message is that perceptions and behaviors are not necessarily the same. There were no statistically significant differences in overall safety-culture ratings between management staff, frontline workers, and HSE professionals. These findings represent the general perceptions of respondents and do not indicate differences or similarities in specific dimensions of organizational safety culture.

The near miss reporting presented additional variation. It differed primarily due to organizational factors, particularly the “feelings of empowerment” and management responsiveness. Employees who felt they had the authority to stop unsafe work were more likely to report near misses if they believed their concerns had been considered, and if they felt they were truly authorized to stop unsafe work. This signals the importance of credibility of leadership and possible impact

of psychological safety in an operational context.

Perceived safety-culture ratings differed significantly across reported hazard categories, although the effect size was small. In contrast, no statistically significant association was detected between hazard category and reporting-and-follow-up status. This does not mean hazards are irrelevant. Instead, the hazard environment itself is not enough to ensure the initiation and continuation of reporting. Feedback, trust and response credibility have a greater impact on the transformation of concerns into reports, learning and corrective action.

The study provides much-needed empirical data for Iraq, where research in oil-sector safety has been limited. In practice, priorities are to reinforce follow-up of management and to keep them traceable, to maintain stop work authority and to ensure that safety communication is consistent between sites and shifts. The assessment of the safety culture was based on a single four-level item, not a validated multidimensional instrument. This has the effect of reducing the scope for exploring the culture itself, such as norms and psychological safety. These aspects could be further explored in future research through the use of existing multidimensional scales. While the cross-sectional design and self-reported data do not allow for causality, the results do offer an empirical foundation for further comparisons and longitudinal research in oil-rich settings. A real operational authority for employees and accountability for leadership results in more trustworthy reporting and more resilient performance of the employee's safety skills.

REFERENCES

[1] Rocha, R.S., Duarte, F., Lima, F.P.A., et al. (2024). Framework for the assessment of the safety culture in the oil and gas industry. International Journal of Occupational Safety and Ergonomics, 30(1): 224-237. https://doi.org/10.1080/10803548.2023.2293389

[2] Jiang, Z., Zhao, X., Wang, Z., Herbert, K. (2024). Safety leadership: A bibliometric literature review and future research directions. Journal of Business Research, 172: 114437. https://doi.org/10.1016/j.jbusres.2023.114437

[3] Paselk, A. (2025). The impact of cultural dimensions and supervisory leadership on safety climate in multinational oil and gas operations. Safety Management and Human Factors, 189: 153-167. https://doi.org/10.54941/ahfe1006581

[4] Imanudin, A.F. (2025). Exploring safety culture maturity models: A systematic review of approaches, assessment elements, and industrial contexts. COMSERVA: Jurnal Penelitian dan Pengabdian Masyarakat, 5(2): 736-749. https://doi.org/10.59141/comserva.v5i2.3216

[5] Ehiaguina, E., Nnadi, B.C., Rangarajan, R., Moda, H.M. (2024). Safety culture assessment in petroleum industry: Cross sectional survey of workers safety performance in the Niger Delta Region, Nigeria. Safety in Extreme Environments, 6: 235-247. https://doi.org/10.1007/s42797-024-00104-z

[6] Naji, G.M.A., Isha, A.S.N., Mohyaldinn, M.E., et al. (2021). Impact of safety culture on safety performance; Mediating role of psychosocial hazard: An integrated modelling approach. International Journal of Environmental Research and Public Health, 18(16): 8568. https://doi.org/10.3390/ijerph18168568

[7] Gyambrah, R., An, M., Stemn, E. (2024). Practitioners' perspectives on health and safety risk management in the Ghanaian oil and gas industry. Safety Science, 177: 106579. https://doi.org/10.1016/j.ssci.2024.106579

[8] Adjekum, D.K., Afari, S.A., Owusu-Amponsah, N.Y., et al. (2023). Development of a generative voluntary safety reporting culture (GVSRC) model for the Gulf of Mexico (GOM) oil and gas (O&G) sector using attributes of the aviation safety action program (ASAP). Safety Science, 161: 106073. https://doi.org/10.1016/j.ssci.2023.106073

[9] Khdair, W.A., Shamsudin, F.M., Subramaniam, C. (2011). Improving safety performance by understanding relationship between management practices and leadership behavior in the oil and gas industry in Iraq: A proposed model. In Proceedings of the 2011 International Conference on Management and Artificial Intelligence, Bali, Indonesia, pp. 85-93.

[10] Aven, T., Ylönen, M. (2021). How the risk science can help us establish a good safety culture. Journal of Risk Research, 24(11): 1349-1367. https://doi.org/10.1080/13669877.2020.1871056

[11] Bautista-Bernal, I., Quintana-García, C., Marchante-Lara, M. (2024). Safety culture, safety performance and financial performance: A longitudinal study. Safety Science, 172: 106409. https://doi.org/10.1016/j.ssci.2023.106409

[12] Al-Mekhlafi, A.B.A., Kanwal, N., Alhajj, M.N., Isha, A.S.N., Baarimah, A.O. (2025). Trends in safety culture research: A Scopus analysis. Safety, 11(2): 33. https://doi.org/10.3390/safety11020033

[13] Adeoye, A.T., Olisakwe, H.C., Adebayo, Y.A., Esiri, A.E. (2024). Behavioral safety programs in high-risk industries: A conceptual approach to incident reduction. Comprehensive Research and Reviews in Engineering and Technology, 2(1): 64-82. https://doi.org/10.57219/crret.2024.2.1.0062

[14] Levovnik, D., Aleksić, D., Gerbec, M. (2025). Examining the relationship between managers' commitment to safety, leadership style, and employees' perception of managers' commitment. Journal of Safety Research, 92: 230-244. https://doi.org/10.1016/j.jsr.2024.11.024

[15] Quansah, P.E., Zhu, Y., Guo, M. (2023). Assessing the effects of safety leadership, employee engagement, and psychological safety on safety performance. Journal of Safety Research, 86: 226-244. https://doi.org/10.1016/j.jsr.2023.07.002

[16] Al-Bayati, A.J., Chellappa, J. (2025). Identifying desirable safety actions of upper management to foster higher levels of construction safety culture. Journal of Construction Engineering and Management, 151(7): 04025077. https://doi.org/10.1061/JCEMD4.COENG-15913

[17] Zohar, D. (1980). Safety climate in industrial organizations: Theoretical and applied implications. Journal of Applied Psychology, 65(1): 96-102. https://doi.org/10.1037/0021-9010.65.1.96

[18] Reason, J. (1997). Managing the Risks of Organizational Accidents. Ashgate.

[19] Cooper, M.D. (2000). Towards a model of safety culture. Safety Science, 36(2): 111-136. https://doi.org/10.1016/S0925-7535(00)00035-7

[20] Hudson, P. (2007). Implementing a safety culture in a major multi-national. Safety Science, 45(6): 697-722.

https://doi.org/10.1016/j.ssci.2007.04.005
[21] Hale, A., Borys, D. (2013). Working to rule or working safely? Part 2: The management of safety rules and procedures. Safety Science, 55: 222-231. https://doi.org/10.1016/j.ssci.2012.05.013
[22] Adra, I., Giga, S., Hardy, C., Leka, S. (2024). What is safety leadership? A systematic review of definitions. Journal of Safety Research, 90: 181-191. https://doi.org/10.1016/j.jsr.2024.04.001
[23] Payne, M., Roache, D., Subero, J., Zhang, G.P. (2025). How safety leadership styles impact safety performance: A case study. Journal of Safety Research, 93: 214-228. https://doi.org/10.1016/j.jsr.2025.02.006
[24] Yamamoto, A., Nagata, T., Odagami, K., Adi, N.P., Nagata, M., Mori, K. (2024). Relationship between companies' responses to near-miss reports and turnover intentions of workers: A nationwide cross-sectional study. Safety and Health at Work, 15(2): 187-191. https://doi.org/10.1016/j.shaw.2024.01.004
[25] Probst, T.M., Bettac, E.L., Austin, C.T. (2019). Accident under-reporting in the workplace. In Increasing Occupational Health and Safety in Workplaces, Cheltenham, UK: Edward Elgar Publishing, pp. 30-47. https://doi.org/10.4337/9781788118095.00009
[26] Rahim, H., Dapari, R., Che Dom, N., Mohd Noor, M.I. (2024). Decoding stakeholder priorities of safety culture preferences in the oil and gas industry. Scientific Reports, 14: 20735. https://doi.org/10.1038/s41598-024-71294-6
[27] Mearns, K., Whitaker, S.M., Flin, R. (2003). Safety climate, safety management practice and safety performance in offshore environments. Safety Science, 41(8): 641-680. https://doi.org/10.1016/S0925-7535(02)00011-5
[28] Ofori, E.K., Aram, S.A., Saalidong, B.M., et al. (2023). Exploring new antecedent metrics for safety performance in Ghana's oil and gas industry using partial least squares structural equation modelling (PLS-SEM). Resources Policy, 81: 103368. https://doi.org/10.1016/j.resourpol.2023.103368
[29] Wang, X., Sasangohar, F., Payne, S., Mehta, R.K. (2024). Safety culture and worker fatigue management in the offshore oil and gas industry: An interview study. International Journal of Industrial Ergonomics, 102: 103614. https://doi.org/10.1016/j.ergon.2024.103614
[30] Kearney, G.D., Hisel, J., Staley, J.A. (2025). Effectiveness of toolbox talks as a workplace safety intervention in the United States: A scoping review. Safety, 11(2): 35. https://doi.org/10.3390/safety11020035
[31] Djunaidi, Z., Wirawan, M., Susilowati, I.H., Khaliwa, A.M., Kanigara, S.A. (2024). Safety climate transformation in oil and gas company ownership transition: Study case from multinational to national company. Safety and Health at Work, 15(3): 292-299. https://doi.org/10.1016/j.shaw.2024.04.009
[32] Cowley, C., Denyer, D., Kutsch, E., Turnbull James, K. (2021). Constructing safety: Reconciling error prevention and error management in oil and gas and petrochemical operations. Academy of Management Discoveries, 7(4): 554-580. https://doi.org/10.5465/amd.2019.0190
[33] Rahim, H., Dapari, R., Osman, M.A., Che Dom, N. (2026). A behaviourally informed digital framework for safety culture transformation in the oil and gas industry. Scientific Reports, 16: 15155. https://doi.org/10.1038/s41598-026-45794-6
[34] Ghorbani, M., Ebrahimi, H., Vosoughi, S., Eskandari, D., Moradi Hanifi, S., Mandali, H. (2024). Analyzing the influential factors of process safety culture by hybrid hidden content analysis and fuzzy DEMATEL. Scientific Reports, 14: 1470. https://doi.org/10.1038/s41598-024-52067-7
[35] Lee, J., Sylvara, A., Choi, J., Lee, S. (2023). On different pages? More dangerous than a papercut: Implications of incongruence between leader and member safety climate perceptions. Safety Science, 163: 106111. https://doi.org/10.1016/j.ssci.2023.106111
[36] Piao, J., Hahn, J. (2026). The paradox of safety communication: The effect of communication framing on psychological safety and reporting intention in organizations. Human Factors and Ergonomics in Manufacturing & Service Industries, 36(4): e70052. https://doi.org/10.1002/hfm.70052
[37] Chen, Y.P., Hsu, Y.S., Panaccio, A., Wang, H. (2025). Leading the way to a safer workplace: What enables supervisors to be servant leaders and enhance subordinates' workplace safety behaviors? Journal of Safety Research, 93: 31-43. https://doi.org/10.1016/j.jsr.2025.02.005
[38] Lin, N.W., Ramirez-Cardenas, A., Wingate, K.C., King, B.S., Scott, K., Hagan-Haynes, K. (2024). Risk factors for heat-related illness resulting in death or hospitalization in the oil and gas extraction industry. Journal of Occupational and Environmental Hygiene, 21(1): 58-67. https://doi.org/10.1080/15459624.2023.2268142
[39] Alomari, K., Abdulridha, N.A., Al-Bayati, A.J., Muttashar, M. (2020). Occupational safety basics understanding in oil and gas industry: An evaluation. Periodicals of Engineering and Natural Sciences, 8(4): 2255-2262. https://doi.org/10.21533/pen.v8.i4.1394
[40] Ying, M., Allaqtta, M.A.M. (2025). The impact of safety culture, risk mitigation, and sustainability on business performance: The mediating role of employee engagement in Palestinian small and medium-sized enterprises. Sustainability, 17(10): 4361. https://doi.org/10.3390/su17104361
[41] Malm, T., Tiusanen, R., Heikkilä, E., Sarsama, J. (2022). Safety risk sources of autonomous mobile machines. Open Engineering, 12(1): 977-990. https://doi.org/10.1515/eng-2022-0377