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Evaluation and Gap Analysis of ISO 45001 Implementation for Occupational Health and Safety at Brega Oil Marketing Company

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تقييم وتحليل الفجوات في تطبيق معيار *ISO 45001* للصحة والسلامة المهنية في شركة البريقة لتسويق النفط

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Abstract:

This study assesses the implementation level of the Occupational Health and Safety Management System (OHSMS) based on ISO 45001:2018 at Brega Oil Marketing Company (BOMC), Libya. A quantitative descriptive methodology was employed using a structured questionnaire derived from ISO 45001 clauses. Data were collected from 60 employees across four operational sites and analyzed using descriptive statistics in IBM SPSS. The results indicate partial compliance with ISO 45001 requirements (mean ≈ 3.82). Strong performance was observed in safety awareness and employee satisfaction, whereas weaknesses were identified in planning, hazard identification, and performance evaluation processes. The study recommends strengthening risk-based planning and internal auditing mechanisms to improve system effectiveness and ensure continual improvement.

Keywords: Occupational Health and Safety, ISO 45001, Gap Analysis, Oil and Gas Industry, Brega Oil Marketing Company.

الملخص

تُقيّم هذه الدراسة مستوى تطبيق نظام إدارة الصحة والسلامة المهنية (OHSMS) استنادًا إلى معيار International Organization for Standardization ISO 45001:2018 في شركة البريقة لتسويق النفط في ليبيا. تم استخدام منهجية وصفية كمية بالاعتماد على استبيان منظم مُشتق من بنود معيار ISO 45001. وجُمعت البيانات من 60 موظفًا موزعين على أربعة مواقع تشغيلية، ثم جرى تحليلها باستخدام الإحصاء الوصفي عبر برنامج IBM SPSS Statistics.. أظهرت النتائج وجود التزام جزئي بمتطلبات ISO 45001، بمتوسط يقارب (3.82). وقد لوحظ أداء قوي في مجال الوعي بالسلامة ورضا الموظفين، في حين ظهرت نقاط ضعف في التخطيط، وتحديد المخاطر، وعمليات تقييم الأداء. وتوصي

الدراسة بتعزيز التخطيط القائم على المخاطر وآليات التدقيق الداخلي من أجل تحسين فعالية النظام وضمان التحسين المستمر.

الكلمات المفتاحية: الصحة والسلامة المهنية، آيزو 45001، تحليل الفجوات، صناعة النفط والغاز، شركة البريقة لتسويق النفط.

I. Introduction

Occupational Health and Safety (OHS) has become a critical concern in modern industrial environments due to the increasing complexity of operations and the presence of diverse workplace hazards. As industries adopt advanced technologies and expand their operational activities, structured safety management systems have become essential to protect employees and maintain operational reliability. [1], [2]

The oil and gas sector is widely recognized as one of the most hazardous industries because of the presence of flammable materials, high-pressure systems, heavy equipment, and complex operational processes. If these risks are not effectively managed, they may lead to serious injuries, environmental damage, asset losses, and operational disruptions. [5], [6]

To address such risks, organizations increasingly adopt international management standards. ISO 45001:2018 provides a structured framework for Occupational Health and Safety Management Systems (OHSMS), enabling organizations to systematically identify hazards, assess risks, and continuously improve safety performance through leadership commitment, worker participation, and risk-based thinking. [3], [4]

In Libya, several energy-sector organizations are working to align their safety practices with international standards. Brega Oil Marketing Company (BOMC), one of the main downstream petroleum companies in Libya, is responsible for fuel storage, handling, and distribution activities. Due to the high-risk nature of these operations, evaluating the level of ISO 45001 implementation is essential to ensure effective occupational health and safety management and support continuous improvement.

Problem Statement

Despite ongoing efforts to improve occupational health and safety practices at Brega Oil Marketing Company (BOMC), there is limited documented evidence evaluating the level of compliance with ISO 45001:2018 requirements. Without a structured gap analysis, potential deficiencies in hazard identification, risk assessment, employee competence, documentation procedures, and performance monitoring may remain unidentified.

The absence of such an evaluation may limit the company's ability to fully align with international OHS standards and may expose operational sites to preventable safety risks. Therefore, a systematic assessment is necessary to determine the current level of implementation and identify areas requiring improvement.

Research Objectives

The main objective of this study is to evaluate the implementation of ISO 45001:2018 and identify gaps within the Occupational Health and Safety Management System at Brega Oil Marketing Company.

The specific objectives of the study are**:**

1. To assess the company's current level of compliance with the requirements of ISO 45001 (OHSMS aspects: context of the organization, leadership & worker participation, planning, support, operation, performance evaluation, and improvement).
2. To identify strengths and weaknesses in the existing OHS practices by analyzing gaps between the company's current OHS procedures and the ISO 45001 requirements.

3. To provide recommendations for enhancing compliance and improving overall safety performance.

II. Literature Review

A. Occupational Health and Safety Management Systems (OHSMS)

Occupational Health and Safety Management Systems (OHSMS) represent structured organizational frameworks designed to manage workplace hazards, reduce occupational risks, and promote a safe working environment. These systems integrate policies, procedures, responsibilities, and operational practices that allow organizations to systematically identify hazards, assess risks, and implement effective control measures to protect employees and improve workplace safety. [1], [2]

Occupational Health and Safety (OHS) is considered a multidisciplinary field that focuses on protecting the safety, health, and welfare of workers in different occupational environments. According to the International Labour Organization (ILO), occupational health aims to promote and maintain the highest degree of physical, mental, and social well-being of workers while preventing work-related injuries and illnesses. [2]

Implementing an effective OHS management system provides multiple benefits for organizations. It helps reduce workplace accidents, improve operational performance, enhance employee confidence, and minimize financial losses caused by workplace incidents. Direct costs such as medical treatment and compensation are often accompanied by indirect costs including production losses, equipment damage, investigation expenses, and administrative delays. [3], [8], [9]

B. ISO 45001 Standard and Its Importance

ISO 45001:2018 is the first international standard that specifies requirements for an Occupational Health and Safety Management System (OHSMS). The standard provides organizations with a globally recognized framework to proactively improve occupational health and safety performance and prevent work-related injuries and illnesses. [3], [4]

The primary objectives of ISO 45001 include establishing a proactive system that enables organizations to eliminate hazards, minimize occupational risks, and ensure compliance with applicable legal and regulatory requirements. In addition, the standard emphasizes worker consultation and participation as essential elements for maintaining an effective safety culture. [3], [4], [14]

ISO 45001 replaced the previous OHSAS 18001 standard, which had been widely used as a certifiable specification for managing occupational health and safety risks. Although OHSAS 18001 provided a structured framework for safety management, ISO 45001 introduced significant improvements, including stronger leadership accountability, enhanced worker participation, and integration with other ISO management systems through the High-Level Structure (HLS). [8], [14], [15]

Furthermore, ISO 45001 follows the Plan–Do–Check–Act (PDCA) model, which promotes continuous improvement in safety performance through systematic planning, implementation, monitoring, and corrective actions. [4], [14]

C. Occupational Health and Safety in the Oil and Gas Industry

The oil and gas industry is widely recognized as one of the most hazardous industrial sectors due to the presence of flammable materials, high-pressure systems, heavy equipment, and complex operational environments. If these risks are not effectively controlled, they may result in serious accidents such as fires, explosions, toxic releases, and major operational disruptions. [5], [6], [16]

In the downstream sector, which includes fuel refining, storage, transportation, and marketing operations, occupational health and safety management becomes particularly critical. Oil terminals and storage facilities involve the handling and transfer of large volumes of petroleum products, creating conditions where major accident scenarios may occur if proper safety measures are not implemented. [7], [16]

Key hazard categories in these environments include process safety hazards such as fire and explosion risks, transportation hazards related to tanker operations, and occupational health hazards such as chemical exposure and confined-space work. Therefore, implementing effective safety management systems and strong emergency preparedness plans is essential to ensure safe operations in the oil and gas sector. [1], [4], [7]

D. Previous Studies

This section reviews empirical studies related to the implementation of ISO 45001:2018 in oil, refinery, and petrochemical sectors, particularly within the Middle East and Libya, to provide a contextual basis for the current study on Brega Oil Marketing Company (BOMC).

In Libya, Elsaghier, Karrab, and Abudabbus (2023) [22] examined the establishment of an Occupational Health and Safety Management System (OHSMS) in Waha Oil Company using a gap analysis aligned with ISO 45001 requirements. The study reported high safety awareness among employees but identified weaknesses in documentation, risk assessment procedures, and emergency response integration.

In the refinery sector, Al-Jubouri (2023) [17] evaluated ISO 45001 implementation at the Baghdad Refinery using questionnaires and standard-based checklists, finding a relatively low implementation level (44.7%) mainly due to limited management commitment and insufficient safety resources. Similarly, Al-Khaqani (2023) [18] assessed OHS practices in the Southern Oil Company and reported significant gaps in hazard identification and performance evaluation.

Using a case study approach, Al-Shamari (2021) [19] examined compliance in the Central Refineries Company and identified a large implementation gap (about 60%), particularly in Clause 6 (Planning) and Clause 8 (Operation), which are critical for controlling industrial hazards.

In the petrochemical sector, Al-Ghamdi (2021) [20] highlighted that organisational culture change and effective worker participation are among the main challenges of ISO 45001 implementation. Within the Libyan context, Awad (2025) [23] emphasized the need to strengthen safety culture, training, and risk management practices in oil companies, while Elbagnog (2025) [24] showed that effective occupational safety programs can improve organisational performance and support sustainable development.

Overall, previous studies reveal recurring gaps in leadership commitment, planning, risk management, and performance evaluation, supporting the need to assess ISO 45001 implementation at BOMC through a clause-based gap analysis.

III. Methodology

A. Research Design

This study adopted a quantitative descriptive research design to evaluate the level of implementation of ISO 45001:2018 at Brega Oil Marketing Company (BOMC). The research employed a structured gap analysis approach based on selected clauses of ISO 45001 in order to measure the extent of compliance with Occupational Health and Safety Management System (OHSMS) requirements.

A quantitative approach was selected to allow objective measurement of employee perceptions regarding the practical application of OHS procedures across operational sites. The descriptive design enabled the study to assess the current implementation status without manipulating

variables, thereby providing a realistic representation of the existing safety management system.

B. Study Population and Sample

The study population consisted of employees working in operational units of Brega Oil Marketing Company. The research focused on four major sites representing downstream fuel storage and distribution activities:

- Tripoli Depot
- Tripoli Airport Aviation Fuel Depot
- Al-Hani Depot
- Bin Jaber Depot

These sites were selected due to their operational importance and exposure to high-risk activities such as fuel storage, handling, and transportation logistics.

A total of 60 employees participated in the study. Participants included operational staff, supervisors, and safety-related personnel to ensure that responses reflected practical experience with safety procedures. The sample provided a representative view of ISO 45001 implementation across the selected operational units.

Table (1) Questionnaire Distribution and Response Rate by Site

Site / Depot	**Distributed (n)**	**Returned (n)**	**Valid Used (n)**	**Excluded (n)**	**Response Rate (%)**
Tripoli Depot	40	36	25	11	**90.0%**
Al-Hani Depot	18	15	12	3	**83.3%**
Bin Jaber Depot	22	20	12	8	**90.9%**
Tripoli Airport Aviation Fuel Depot	16	16	11	5	**100.0%**
Total	**96**	**87**	**60**	**27**	**90.6%**

C. Data Collection Instrument

Data were collected using a structured questionnaire checklist developed directly from the clauses of ISO 45001:2018. The instrument was designed to evaluate key components of the Occupational Health and Safety Management System.

The questionnaire included items covering the following areas:

- Leadership and Worker Participation (Clause 5)
- Planning and Hazard Identification (Clause 6)
- Support, Competence, and Awareness (Clause 7)
- Operational Control and Emergency Preparedness (Clause 8)
- Performance Evaluation (Clause 9)
- General safety awareness and satisfaction

Each item was formulated to measure the degree to which ISO 45001 requirements are practically applied within daily operations.

D. Measurement Scale

Responses were measured using a five-point Likert scale structured as follows:

1= Strongly Disagree

2 = Disagree

3 = Neutral
4 = Agree
5 = Strongly Agree

This scale allowed the calculation of mean scores for each clause and facilitated the classification of implementation levels.
To support gap analysis, implementation levels were interpreted as:

- Mean ≥ 4.0 → Full Compliance
- Mean between 3.0 and 3.9 → Partial Compliance
- Mean < 3.0 → Weak Implementation

E. Data Analysis Techniques

Collected data were analyzed using IBM SPSS statistical software. Descriptive statistical methods were applied, including:

- Frequencies
- Percentages
- Mean values

Clause-level mean scores were calculated to determine the implementation strength of each ISO 45001 requirement. The overall mean score was also computed to assess the general implementation level of the OHSMS at BOMC.
The results were then interpreted through a structured gap analysis framework, identifying areas of strength, partial implementation, and weakness. This analytical approach enabled the formulation of targeted recommendations aimed at strengthening system maturity and supporting continual improvement.

IV. Results

A. Demographic Characteristics

A total of 60 completed questionnaires were collected from employees working across different functional levels. The distributions of job positions and years of experience are summarized in Tables 2 and 3.

Table (2). Respondent distribution by job position (n = 60).

Job position	**Frequency**	**Percentage (%)**
Technical staff	25	41.7
Supervisory staff	20	33.3
Administrative staff	15	25.0

The table shows that technical staff make up the largest part of the sample (41.7%), followed by supervisory staff (33.3%), and administrative staff (25%). This reflects the nature of work at Brega Oil Marketing Company, which depends mainly on technical and field employees. Therefore, the results are more reliable because they come from staff who are most exposed to workplace risks.

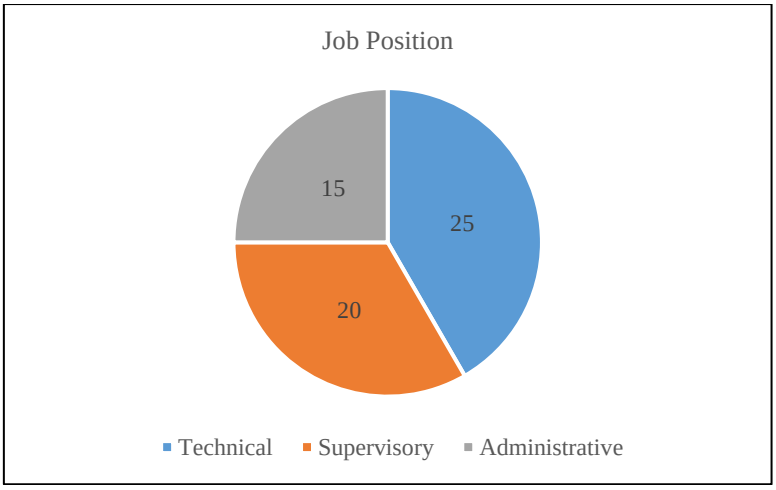

Figure 4.1 Respondent distribution by job position.

Table (3) . Respondent distribution by years of experience (n = 60).

Years of experience	**Frequency**	**Percentage (%)**
Less than 5 years	12	20.0
5–10 years	15	25.0
11–20 years	16	26.7
More than 20 years	17	28.3

The table shows a well-distributed range of work experience among respondents. Employees with more than 20 years of experience represent the largest group (28.3%), followed by those with 11–20 years (26.7%) and 5–10 years (25.0%). Staff with less than 5 years of experience account for 20.0% of the sample. Overall, this spread suggests that the findings reflect perspectives from both experienced personnel and newer employees, supporting a balanced assessment of ISO 45001 implementation.

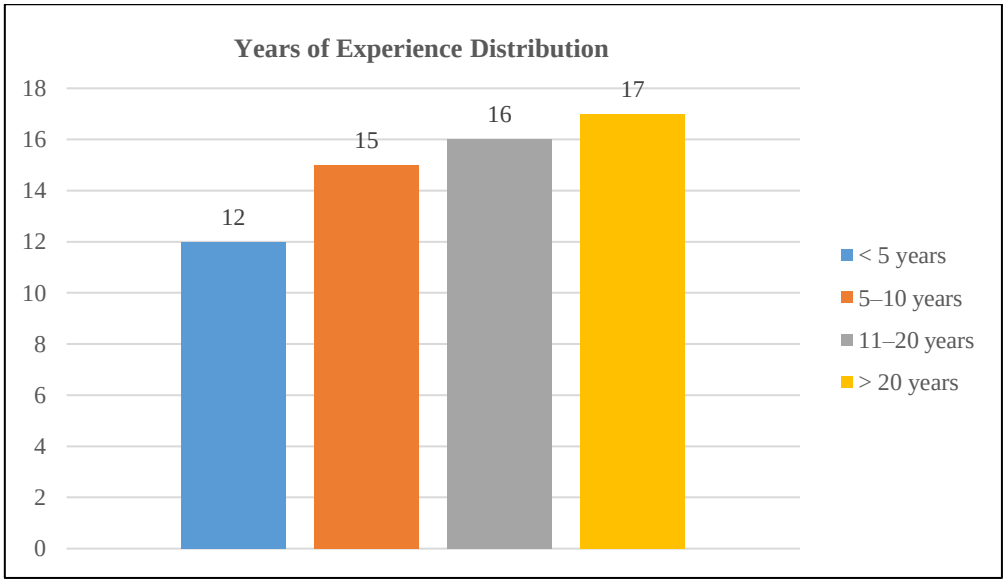

Figure 4.2 Respondent distribution by years of experience.

B. ISO 45001 clause-level compliance

Table (4) ISO 45001 clause-level compliance summary and classification**.**

ISO 45001 area / clause	Mean	Std. dev.	Compliance level
Awareness and Understanding (Clause 7.3)	4.13	0.96	Full compliance
Leadership and Management Commitment (Clause 5)	3.80	1.11	Partial compliance
Planning and Hazard Identification (Clause 6)	3.69	1.16	Partial compliance
Support, Training, and Communication (Clause 7)	3.74	1.09	Partial compliance
Operation and Emergency Preparedness (Clause 8)	3.91	1.09	Partial compliance
Performance Evaluation and Improvement (Clause 9)	3.63	1.15	Partial compliance
General Satisfaction and Overall Perception	4.17	0.97	Full compliance
Overall (all questionnaire items)	3.85	1.10	Partial compliance

Table (5): Full Item List (Q1–Q47) in Questionnaire Order

Q	Statement	Mean	Std. Dev.
Q1	I am aware that the company applies the ISO 45001 occupational health and safety management system.	4.17	0.78
Q2	I have been informed of the system objectives and related policies.	3.75	1.00
Q3	I understand how my work contributes to achieving occupational health and safety objectives.	4.57	0.59
Q4	I have received sufficient training or awareness on the requirements of the system.	3.50	1.30
Q5	I know the procedures that should be followed in the event of an accident.	4.18	0.83
Q6	I know how to report hazards or unsafe practices.	4.37	0.71
Q7	Awareness materials (boards, posters, leaflets) about OHS are provided.	4.35	0.94
Q8	Top management demonstrates clear commitment to the safety and health of employees.	4.28	0.80
Q9	Management provides the necessary resources to implement the safety management system.	3.92	1.00
Q10	Management communicates regularly about occupational health and safety issues.	3.95	0.91

Q11	Top management actively participates in safety meetings or field safety walks.	3.95	0.87
Q12	Managers and supervisors encourage a 'safety first' culture.	3.77	1.09
Q13	Management responds quickly to any reports of hazards or incidents.	3.93	1.02
Q14	Employees who comply with safety procedures are rewarded or recognised.	2.78	1.35
Q15	Hazards and potential risks in my work environment are identified regularly.	3.97	1.09
Q16	I participate in, or am consulted on, risk assessment in my area.	3.42	1.31
Q17	Effective controls are implemented after risks are identified.	3.68	1.07
Q18	Safety plans are updated when new operations or new equipment are introduced.	3.90	0.99
Q19	There is a clear system to identify and evaluate opportunities for improvement in safety.	3.63	1.15
Q20	I am involved in setting safety objectives for the department or unit.	3.53	1.31
Q21	Preventive procedures are reviewed periodically.	3.73	1.04
Q22	Personal protective equipment is always available and sufficient.	3.83	1.04
Q23	I received practical training on how to use safety equipment.	3.82	0.98
Q24	Safety communication channels are clear and easy (e.g., email, noticeboards, meetings).	3.70	1.17
Q25	I am informed of any changes that may affect my safety at work.	3.93	0.86
Q26	Technical or supervisory support is available when facing new hazards.	4.25	0.84
Q27	My observations about the work environment are taken seriously.	4.15	0.73
Q28	I feel that the internal safety communication system is effective and clear.	2.90	1.53
Q29	Daily operations are performed according to approved safety procedures.	3.67	1.04
Q30	There are clear instructions for dealing with emergency situations.	4.17	0.91
Q31	I participated in emergency simulation drills during the last few years.	4.18	0.79
Q32	Risk assessment outputs are actually applied in the field.	4.07	0.99
Q33	All equipment is fitted with clear warning signs.	3.98	0.87
Q34	Emergency tools and equipment are periodically checked for validity/fitness.	3.92	1.05
Q35	I know the safety responsible persons at my site and how to contact them.	3.42	1.18
Q36	Safety performance indicators are monitored periodically.	4.07	0.80
Q37	Incidents and errors are analysed to identify root causes.	3.50	1.26
Q38	We are informed of the results of safety audits or reviews.	3.07	1.16
Q39	I notice real improvement in safety rates since the system was applied.	3.45	1.31
Q40	A periodic assessment of employee satisfaction with a safe work environment is conducted.	3.70	1.17
Q41	Management shares internal review/audit results with employees.	3.97	1.01
Q42	There is transparency in announcing the corrective actions taken.	3.88	0.96
Q43	I am satisfied with the current work environment in terms of safety.	4.58	0.62
Q44	I feel the company genuinely cares about my safety and health.	4.72	0.52

Q45	I believe safety culture has become part of workers' daily behaviour.	3.70	1.17
Q46	I would like to continue working in an environment that applies ISO 45001.	3.97	1.01
Q47	I recommend strengthening incentive and reward programs in the area of safety.	3.88	0.96

V. Discussion

A. Overall Implementation Status and Compliance Level

The findings of this study reveal that Brega Oil Marketing Company (BOMC) has achieved an overall mean score of 3.85. According to the measurement scale used in this research, this score classifies the company's current status as "Partial Compliance" with ISO 45001:2018 requirements. While the organization has successfully transitioned from the previous OHSAS 18001 mindset toward the newer ISO standard, the data suggests a lack of systematic discipline in the Plan-Do-Check-Act (PDCA) cycle. The "Partial Compliance" status indicates that while the technical foundations and safety policies exist, they are not yet fully integrated into a continuous improvement loop that ensures consistency across all operational sites, such as the Tripoli and Aviation Fuel depots.

B. Analysis of Systemic Strengths: Awareness and Safety Culture

One of the most significant strengths identified is the high level of Awareness and Understanding (Clause 7.3), which earned a mean score of 4.13, placing it in the "Full Compliance" zone.

- Employees demonstrated a very high understanding of how their specific work contributes to OHS objectives, with a mean of 4.57.
- There is a strong, positive safety perception among the workforce; for instance, the belief that the company genuinely cares about employee health and safety received one of the highest individual scores (4.72).
- Furthermore, Operation and Emergency Preparedness (Clause 8) showed robust results (mean 3.91), supported by the fact that workers are well-informed of emergency procedures and participate regularly in simulation drills.

C. Identification of Critical Gaps and Strategic Weaknesses

Despite the strong awareness, several strategic gaps hinder full compliance.

- Clause 9 (Performance Evaluation) was identified as a primary weakness with a mean of 3.63.
- A critical specific gap is the lack of transparency regarding audit results; the statement "We are informed of the results of safety audits" received a low mean of 3.07.
- Additionally, the Internal Safety Communication System (Q28) is a major hurdle, scoring only 2.90, which suggests that information flow between management and the field is often one-way rather than a collaborative feedback loop.

D. Behavioral and Administrative Challenges

The data highlights a significant "Incentive Gap" within the administrative framework of BOMC.

- The lowest individual score in the entire study was for the statement regarding rewards or recognition for employees who comply with safety procedures, which averaged only 2.78.
- This indicates that the safety culture is currently maintained through awareness and personal responsibility rather than institutional motivation or positive reinforcement.

- Moreover, while awareness is high, actual consultation and participation in risk assessment (Q16) remains at a partial compliance level (mean 3.42), suggesting that workers are often recipients of safety rules rather than active partners in creating them.

VI. Conclusion

- Overall Compliance Status: BOMC has achieved partial compliance with ISO 45001:2018 (overall mean =3.85). While Clause 7.3 (Awareness) and Safety Satisfaction are strengths, Clauses 5 through 9 remain in the partial compliance zone.
- Strengths: High worker awareness, positive safety perceptions, and relatively strong emergency preparedness/operational indicators.
- Critical Gaps (Priority Weaknesses):
  -Strategic Gaps: Risk-based planning (Clause 6) and Performance evaluation (Clause 9) are the weakest areas.
  -Specific Gaps: A lack of rewards/recognition for safe behavior (Q14) and ineffective internal safety communication (Q28).
- The Verdict: The foundation of the OHSMS exists, but the organization lacks the systematic PDCA (Plan-Do-Check-Act) discipline required for full conformity and cross-site consistency.

VII. Recommendation

Executive Summary: Recommendations Roadmap

The recommendations are prioritized to move from immediate fixes to systemic integration:

1. Immediate "Quick Wins" (The Gaps)

- Incentivize Safety: Launch a formal recognition and reward program for safe behavior and reporting (Q14).
- Active Communication: Establish high-frequency, two-way feedback loops (e.g., daily toolbox talks and noticeboards) (Q28).

2. Systemic Performance (The "Check" phase)

- The Audit Cycle: Implement a formal performance cycle including KPIs, risk-based internal audits, and annual management reviews.
- Accountability: Create a tracking system for corrective actions with assigned owners and strict deadlines.

3. Planning & Risk (The "Plan" phase)

- Standardized Risk Assessment: Harmonize hazard identification across all sites (depots and aviation fuel) with direct worker participation.
- Leadership Presence: Increase visible management engagement through scheduled safety walks and faster responses to reported hazards.

4. Operational Support (The "Do" phase)

- Competence Mapping: Develop a role-based training matrix and ensure the consistent availability of PPE.
- Unified SOPs: Standardize all Operating Procedures and emergency drills to ensure consistency across all geographic locations.

5. Sustainability

- **Lock-in Strengths:** Embed safety awareness and "lessons learned" into the standard induction and routine training to prevent regression.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that they have no conflict of interest.

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