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Employees' Knowledge of OSHA 2007 Provisions and Accident Prevention in the Petroleum Depot Industry in Kenya

Philip Wangulu Maliro[1], Benson Karanja[2], Samuel Thuita[3]
[1,2,3](Department of Occupational Safety and Health, Jomo Kenyatta University of Agriculture and Technology, Kenya)

Abstract:
Petroleum depots concentrate flammable liquid, road-tanker movement, hot work and confined-space maintenance within a single perimeter. Kenya's Occupational Safety and Health Act, 2007 divides the duty of control between occupiers and employees, and much of its preventive machinery — safety and health committees, statutory risk assessment, hazard reporting and accident notification — operates only if employees know what the law asks of them. Despite this framework, the Directorate of Occupational Safety and Health Services documented more than 25 accidents in the sector between 2019 and 2023. This study assessed employees' knowledge of OSHA 2007 provisions and its relationship with accident prevention. A cross-sectional survey was carried out in all ten licensed petroleum depots in Mombasa County, Kenya, between January and April 2025. The target population of 567 comprised 547 lower-cadre employees and 20 supervisors, safety officers and managers. Cochran's formula with a finite population correction yielded 226 lower-cadre respondents drawn by stratified random sampling proportional to depot size; the 20 supervisory staff were enumerated by census, giving 246 respondents, with two regulatory officials as key informants. A structured five-point questionnaire (Cronbach's $\alpha = 0.74$), an interview guide and an observation checklist were used, and data were analyzed in SPSS version 28.0 using descriptive statistics, multiple linear regression and analysis of variance. Of 246 questionnaires, 221 were returned (89.8%). Procedural knowledge was strong: 198 respondents (89.6%) understood the incident reporting and investigation procedure, 191 (86.4%) the risks attached to their own work and 178 (80.5%) reported encouragement to report accidents. Knowledge of the participatory and enforcement provisions was weaker: only 113 (51.1%) were consulted on training needs, 97 (43.9%) confirmed routine toolbox talks, 96 (43.4%) reported supervisory coaching and 82 (37.1%) said inspection results were communicated to all persons, against 111 (50.2%) who denied it. While 209 (94.6%) denied monthly accidents, 194 (87.8%) rejected the statement that no fatal accident had occurred in their depot in five years. Employee awareness of hazards significantly predicted occupational safety and health status ($\beta = 0.58$, $p = 0.005$, $R^2 = 0.41$), and the combined model explained 65% of variance ($\beta = 0.71$, $p = 0.001$; $F = 15.00$, $p < 0.001$). Training was rated the strongest contributor to accident reduction by 193 respondents (87.3%). Depot employees hold sound procedural knowledge of their reporting duties but shallower knowledge of the participatory and enforcement architecture of OSHA 2007. The residue of fatal events alongside near-universal denial of routine accidents indicates that low reported frequency reflects reporting behavior rather than the absence of hazard. Closing the gap requires statutory content in training, mandatory feedback of inspection findings, functioning safety and health committees and audit of knowledge rather than attendance.

Key Word: *OSHA 2007; Petroleum depots; Accident prevention; Employee knowledge; Worker participation; Occupational safety and health; Kenya.*

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I. INTRODUCTION

A petroleum depot is an unusual industrial setting in that almost every routine task carries the potential for a low-frequency, high-consequence outcome. Bulk storage tanks, loading gantries, pipework manifolds, pump rooms and tanker parks concentrate flammable vapour, ignition sources, stored pressure and heavy vehicle movement inside a single perimeter, and the hazard is compounded by tasks that are themselves routine: sampling, dipping, hose connection, hot work and confined-space entry for tank cleaning. Analyses of the oil, gas and petrochemical industries show that the sector's risk profile is dominated not by exotic technical failures but by the interaction of ordinary operational activity with poorly controlled energy sources.[3] Work on major-accident indicators reaches a similar conclusion: precursor events accumulate long before a headline loss and are visible to the workforce before they are visible to management.[4] Field research downstream further shows that human and

organisational factors — supervision, communication, procedural discipline and the willingness to stop unsafe work — account for more of safety performance than hardware integrity alone.[5]

Kenya's petroleum supply chain is anchored at the coast. Mombasa is the principal import, storage and distribution hub for the country and for a hinterland extending into the Great Lakes region, and the depots clustered at Shimanzi, Changamwe and Mbaraki Wharf handle the greater part of national fuel volume.[6] Ten licensed depots operate in the county, employing approximately 567 staff, the overwhelming majority of them lower-cadre operatives working directly at the interface between product and equipment.[7] The quality of practice in a small number of installations therefore carries consequences far beyond the county boundary.

The governing instrument is the Occupational Safety and Health Act, 2007, which replaced the earlier factories legislation and reoriented Kenyan safety law from prescriptive inspection towards a duty-based, self-regulating model.[1] The Act imposes a general duty on every occupier to ensure the safety, health and welfare of all persons at the workplace, requires a written safety and health policy, provides for safety and health committees in workplaces employing a threshold number of employees, mandates periodic audits and risk assessment by competent persons, and requires notification of accidents, dangerous occurrences and occupational diseases to the area occupational safety and health officer. It also imposes duties on employees: to take reasonable care for their own safety and that of others, to cooperate with the occupier, to use provided protective equipment and to report any situation believed to present a hazard. The committee requirement is reinforced by the Factories and Other Places of Work (Safety and Health Committees) Rules, 2004, which set out the composition and functions of the joint committees representing employees.[2]

The architecture of this legislation is explicitly participatory. It does not assume that safety can be delivered to a passive workforce by inspection alone; it presumes an employee who knows that a hazard must be reported, that a committee exists and who sits on it, that a risk assessment should have been carried out for the task at hand, and that reporting an injury attracts a statutory process rather than a penalty. Knowledge is therefore not merely desirable but functionally load-bearing. The Theory of Reasoned Action accounts for why: behavioural intention is shaped by attitude and subjective norms, both constructed from the beliefs an individual holds about the behaviour and its consequences.[23,24] An employee who does not know that the law protects a hazard report cannot form a favourable attitude towards making one. The theory has been criticised for assuming volitional control and underweighting organisational constraints,[25] and its explanatory power is greater when the latent dimensions of safety culture — trust, tacit norms and experience of how past reports were treated — are treated as operating beneath the observable attitudes.[26,27]

International experience supports the link between informed participation and reduced accident rates. Brazil and Chile have institutionalised internal accident-prevention commissions, with reported declines in construction incidents;[12] in the United States, establishments operating participatory programmes record lower injury rates than those that do not engage the workforce in hazard identification;[13] the Swedish safety-representative system and the German works-council model give employees a statutory voice and are associated with lower accident frequency,[14] as is the Australian safety-representative model;[15] and Japanese practice integrates workforce problem-solving into production improvement.[16] Within Africa, the South African Occupational Health and Safety Act has empowered workers to contribute to audits and risk assessments,[17] and Kenyan safety committees in agriculture have improved hazard communication and reduced farm-worker injuries.[18]

The persistent difficulty is the distance between statutory text and workplace practice. Reviews of legal compliance management find that formal adoption of occupational safety and health duties routinely outruns operational implementation,[19] a divergence documented in European regulatory fragmentation,[20] in the uneven enforcement capacity of Asian jurisdictions[21] and in Latin American systems where resourcing rather than legislation is the binding constraint.[22,28] In much of Africa, frameworks exist but enforcement infrastructure and workforce awareness lag, and safety is treated as subordinate to immediate economic need.[29,30] Kenya presents this pattern in a high-hazard setting: notwithstanding the 2007 Act and the 2004 committee rules, the Directorate of Occupational Safety and Health Services documented more than 25 accidents in the petroleum depot industry between 2019 and 2023. What is not established is how much the depot workforce actually knows about the provisions on which the preventive scheme depends.

This study therefore assessed employees' knowledge of OSHA 2007 provisions and its relationship with accident prevention in the petroleum depot industry in Kenya, taking Mombasa County as the setting. Three questions were addressed: what level and kind of statutory knowledge depot employees hold; how that knowledge is acquired and reinforced through training, incident investigation and risk assessment; and how far hazard exposure, occupational safety and health practices and employee awareness jointly explain the status of occupational safety and health. Figure 1 sets out the framework adopted.

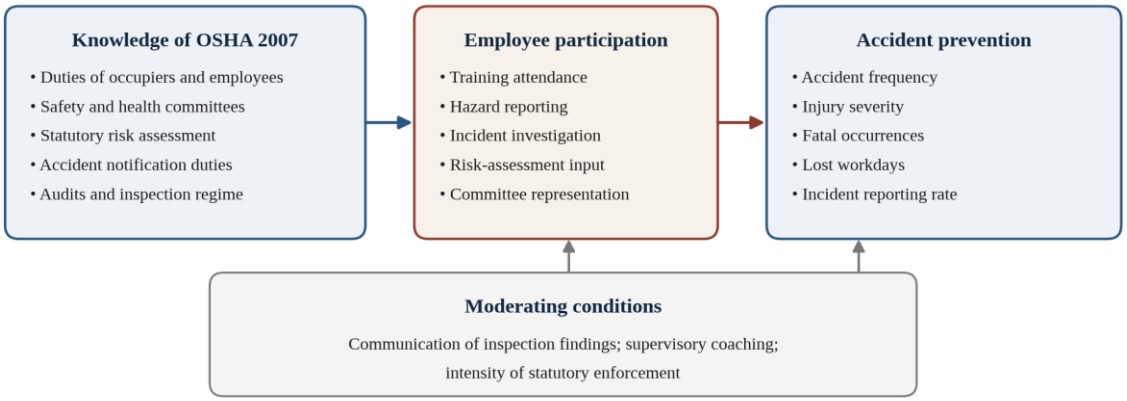

Figure no 1: Framework linking employees' knowledge of OSHA 2007 provisions, participation and accident prevention.

II. MATERIAL AND METHODS

A cross-sectional survey with a predominantly quantitative approach was adopted. The design permits simultaneous measurement of knowledge, attitude and outcome variables across a dispersed workforce at one point in time, and supports examination of the relationships between them without the attrition and cost of longitudinal follow-up in an operational setting.[31,33]

Study design:
Cross-sectional analytical survey, supplemented by key-informant interviews and structured workplace observation.
Study location:
All ten licensed petroleum depots in Mombasa County, Kenya, at Shimanzi, Changamwe and Mbaraki Wharf. Mombasa holds the largest concentration of bulk petroleum storage in the country and therefore the highest aggregate exposure in the sector.
Study duration:
January to April 2025, with key-informant interviews conducted on 12 and 13 March 2025.
Study population:
A total population of 567 depot staff, comprising 547 lower-cadre employees and 20 supervisors, safety officers and managers, distributed as shown in Table 1. Two regulatory key informants were additionally included: the Director of the Department of Occupational Safety and Health and the County Executive Committee Member responsible for health and safety.
Sample size:
246 depot respondents (226 lower-cadre employees and 20 supervisory staff) plus 2 key informants, giving 248 in total.

Sample size calculation:
Cochran's formula was applied to the lower-cadre stratum.[32] For a 95% confidence level ($z = 1.96$), a margin of error of 0.05 and an assumed proportion of $p = 0.5$ for maximum variability, the unadjusted sample size was $n_0 = z^2p(1 - p)/e^2 = 384$. Applying the finite population correction for N = 547 gave $n = 384 / [1 + (384 - 1)/547] = 226$. The resulting sampling fraction of 0.413 was applied proportionally to each depot stratum (Table 1). The 20 supervisors, safety officers and managers were enumerated in full by census rather than sampled, because the group is small and its members hold the decision rights over training, inspection and investigation that the study sought to characterise.

Table no 1: Study population and proportional sample distribution across the ten petroleum depots in Mombasa County.

Depot	Location	Supervisors / safety officers / managers	Lower-cadre employees	Lower cadre sampled (0.413 × N)	Total sampled
Gapco Depot	Shimanzi	3	40	17	20
Vivo Energy (Shell)	Shimanzi	3	61	25	28
Oil Libya	Shimanzi	2	61	25	27

Depot	Location	Supervisors / safety officers / managers	Lower-cadre employees	Lower cadre sampled (0.413 × N)	Total sampled
MJT	Shimanzi / Changamwe	3	95	39	42
Hashi Energy	Changamwe	1	57	24	25
KPRL	Changamwe	3	126	51	54
VTTI	Changamwe	1	50	21	22
Tecaflex	Mbaraki Wharf	1	16	7	8
MBTL	Mbaraki Wharf	1	33	14	15
Gulf Energy	Mbaraki Wharf	2	8	3	5
Total		**20**	**547**	**226**	**246**

Source: Energy Regulatory Commission (2024) for population figures; sample distribution computed by the authors.

Subjects and selection method:

Lower-cadre employees were selected by stratified random sampling, each depot forming a stratum, with respondents drawn from personnel registers using a random number sequence. Stratification by depot was preferred to simple random sampling because depot size, ownership and product mix vary considerably, and unstratified selection would have risked over-representing the two largest installations. Supervisory personnel were included by census, and the two regulatory officials selected purposively on the basis of statutory role.

Inclusion criteria:

1. Continuous service at a licensed Mombasa County petroleum depot for at least six months at the time of survey.
2. Duties involving routine physical presence in the operational area (tank farm, gantry, pump room, workshop or tanker park).
3. Formal responsibility for any element of safety training, inspection, investigation or risk assessment.
4. For key informants, a statutory county mandate for occupational safety and health.
5. Written informed consent given.

Exclusion criteria:

1. Staff in off-site administrative, commercial or clerical roles with no operational-area duties.
2. Contractors, casual labour and visiting tanker crews not on the depot payroll, whose duties arise under separate contractual arrangements.
3. Service of less than six months, since induction training may be incomplete.
4. Long-term leave, secondment or medical absence during data collection.
5. Declined consent or withdrawal before completing the instrument.

Procedure methodology:

Three instruments were used. A self-administered structured questionnaire measured knowledge of OSHA 2007 provisions, exposure to training, understanding of incident reporting and investigation, and perceptions of hazard identification, risk assessment and enforcement. Items were scored on a five-point ordinal scale (highly agree, agree, somehow agree, disagree, highly disagree), with a separate five-point contribution scale for the accident-reduction items. A semi-structured interview guide was administered to the two regulatory key informants, and a safety observation checklist was completed during depot walk-throughs to record visible behavioural adherence, including protective equipment use, gantry discipline and emergency preparedness.

The instruments were pilot-tested at petroleum depots in Nairobi City County. The pilot led to rewording of items that conflated the existence of a provision with its effectiveness, and to separation of the reporting item from the investigation-feedback item. Content validity was established by expert review and construct validity examined by exploratory factor analysis. Internal consistency was acceptable (Cronbach's alpha 0.74), and test–retest administration to a subset of respondents confirmed the stability of responses.[33,34]

Questionnaires were administered on site during shift changeovers to minimise operational disruption, and completed instruments were double-entered with discrepancies resolved against the source document. Ethical approval was obtained from the institutional Ethical Review Committee and a research licence from the National Commission for Science, Technology and Innovation; permission was also sought from the county occupational safety and health office and each depot's management. Participation was voluntary and anonymous, no identifying particulars were recorded, and respondents were free to withdraw without consequence.[44]

Statistical analysis:

Data were analysed in the Statistical Package for the Social Sciences version 28.0. Descriptive statistics summarised the distribution of responses, with percentages computed on valid responses per item. Multiple linear regression followed the specification $y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \varepsilon$, where y is the status of occupational safety and health, X_1 hazard exposure, X_2 occupational safety and health practices and X_3 employee awareness of hazards; predictors were entered first singly and then jointly. Analysis of variance and the associated *F* statistic tested model significance, and the coefficient of determination indicated variance explained. A threshold of $p < 0.05$ was taken as significant.[34]

III. RESULT

Response rate:

Of the 246 questionnaires distributed, 221 were completed and returned (89.8%); both key-informant interviews were conducted, giving an overall response of 89.9% (Table 2). The 25 non-returns were concentrated in shift-based operational roles and arose principally from rotation and leave rather than refusal. A rate at this level limits the scope for non-response bias, although self-reported safety data remain susceptible to social-desirability and recall effects.[35]

Table no 2: Response rate.

Target group	Sample	Response	Response rate (%)
Questionnaire survey	246	221	89.8
Key-informant interviews	2	2	100.0
Total	**248**	**223**	**89.9**

Source: Field data (2025).

Socio-demographic characteristics:

The respondent profile is summarised in Figure 2. The workforce was predominantly male: 158 men (71.5%) and 63 women (28.5%). Age was concentrated in the productive middle band, the largest group being 31–35 years (54 respondents, 24.4%), followed by 26–30 years (41, 18.6%) and 36–40 years (37, 16.7%), with only 20 (9.0%) above 45. Educational attainment was high and no respondent reported primary education only: 97 (43.9%) held a college qualification, 65 (29.4%) a university degree and 59 (26.7%) had completed secondary education. Tenure clustered in the lower brackets, with 87 (39.4%) at four to six years and 51 (23.1%) at three years or fewer. Two features bear on the knowledge question: the educational level is sufficient to absorb statutory content, so any deficit is unlikely to reflect comprehension; and with over 62% of respondents at six years of service or less, institutional memory of past incidents is thin, so induction and refresher training rather than accumulated experience must carry the burden of transmitting hazard knowledge.[36]

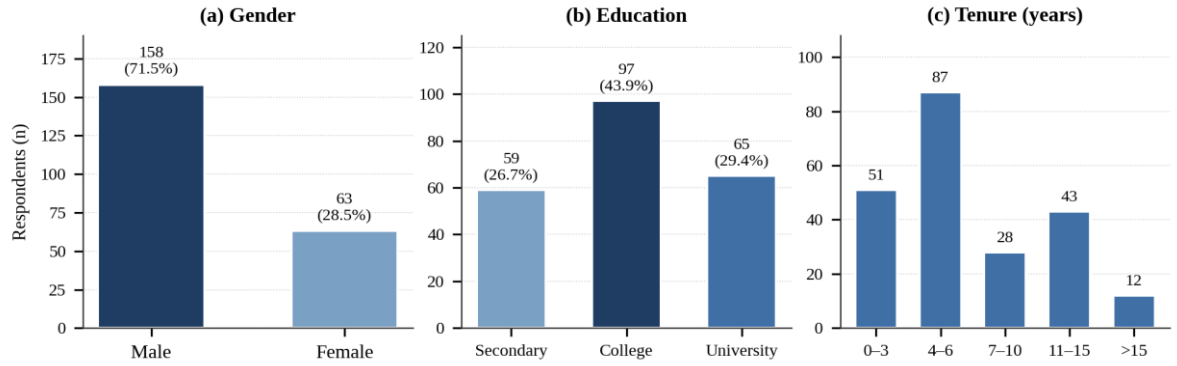

Figure no 2: Socio-demographic characteristics of respondents (n = 221).

Knowledge of OSHA 2007 provisions and reported accident experience:

Table 3 and Figure 3 present responses on the knowledge items relating to accident occurrence, information sharing and reporting. Knowledge of the reporting duty was widely held: 178 respondents (80.5%) confirmed that all staff are encouraged to report accidents as they occur and 161 (72.9%) that accident-occurrence information is shared with staff. Against this, reported accident frequency was very low, with 198 (89.6%) rejecting weekly occurrence and 209 (94.6%) rejecting monthly occurrence.

The third item qualifies the first two. Asked to respond to the statement that no fatal accident had occurred in their depot in the preceding five years, 194 respondents (87.8%) disagreed or highly disagreed — that is, they

affirmed that fatal accidents had occurred — while only 14 (6.3%) agreed that none had. A workforce reporting almost no routine accidents thus simultaneously affirms the sector's most severe outcome. The plausible reading is that severe events are visible, remembered and unavoidably notified, whereas minor injuries and dangerous occurrences are absorbed into normal work and never enter the record.

Table no 3: Level of knowledge on OSHA 2007 provisions relating to accident occurrence and reporting (n = 221).

Statement	Highly agree	Agree	Somehow agree	Disagree	Highly disagree
Accidents occur within our workplace on a weekly basis	11	7	5	98	100
Accidents occur within our workplace at least once a month	5	4	3	95	114
Accident-occurrence information is shared with all staff	86	75	34	16	10
We are all encouraged to report accidents as they occur in the terminal	96	82	31	5	7
No fatal accident has occurred in our depot in the last five years	5	9	13	92	102

Source: Field data (2025).

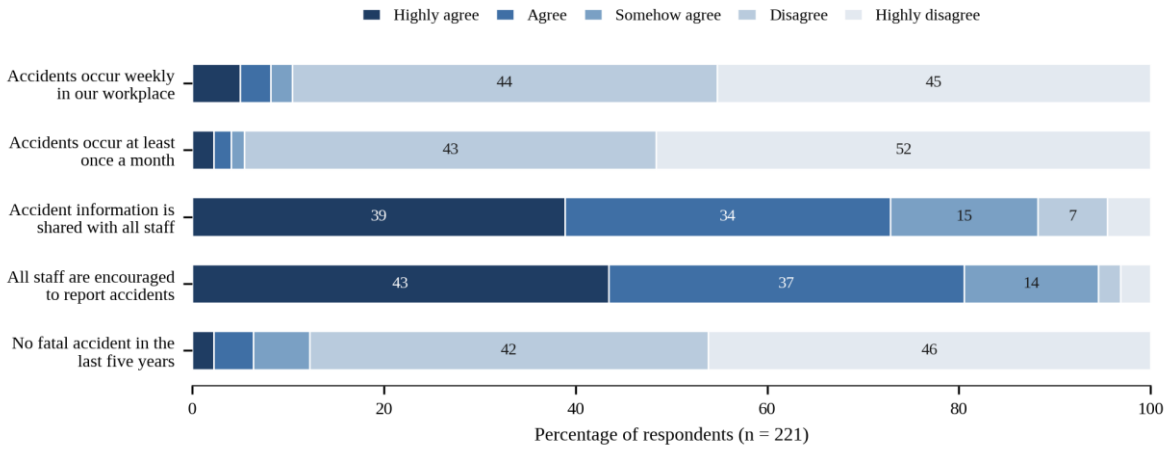

Figure no 3: Distribution of responses on knowledge of accident occurrence, information sharing and reporting.

Knowledge acquisition through safety and health training:

Table 4 shows how statutory and hazard knowledge is transmitted. Formal provision was broadly confirmed: 191 respondents (86.4%) agreed that training forms a key part of organisational training needs and 190 (86.0%) that it is given to most workers at least annually. The mechanisms converting scheduled training into working knowledge were weaker. Only 113 (51.1%) agreed that the organisation seeks workers' views on their training needs, with 79 (35.7%) disagreeing. Supervisory coaching fared worst: 96 (43.4%) reported that their supervisor coaches them in safety requirements during supervision while 105 (47.5%) disagreed — the only item on which disagreement exceeded agreement. Routine toolbox talks were confirmed by 97 (43.9%) and denied by 96 (43.4%), an even split indicating that daily or weekly hazard briefing is established in some depots and absent in others. Peer-facilitated internal training was confirmed by 122 (55.2%). Despite these gaps, 164 (74.2%) attributed safety management success to effective training.

Table no 4: Descriptive statistics on safety and health training (n = 221).

Statement	Highly agree	Agree	Somehow agree	Disagree	Highly disagree
Safety and health training is conducted as a key part of the training needs in the organisation	98	93	13	8	9
Safety and health training is given to most workers at least once a year	103	87	10	11	10
The organisation usually seeks from workers their training needs in safety and health issues	61	52	29	51	28

Statement	Highly agree	Agree	Somehow agree	Disagree	Highly disagree
My supervisor coaches me in safety requirements while supervising my duties	55	41	20	65	40
The organisation allows internal training and awareness facilitated by fellow workers and supervisors	65	57	25	46	28
Daily or weekly awareness sessions are conducted through toolbox talk sessions by our own staff mates	45	52	28	56	40
The success of safety and health management in my organisation is because of effective safety and health training	88	76	21	18	18

Source: Field data (2025).

Knowledge sharing through incident reporting and investigation:

Responses on incident investigation appear in Table 5. Procedural understanding was the highest recorded in the study, 198 respondents (89.6%) confirming that they understand the reporting and investigation procedure. Consultation during investigation was confirmed by 153 (69.2%) and encouragement to suggest preventive improvements by 147 (66.5%). The non-punitive principle was strongly endorsed: of the 161 who answered the item, 93 (57.8%) highly agreed and 37 (23.0%) agreed that employees are not penalised when they become casualties of an accident. The weakest links lay downstream: 142 (64.3%) agreed that outcomes are shared with all employees, with 61 (27.6%) disagreeing, and only 131 (59.3%) attributed safety management success to an effective investigation process. Employees know how to report and are willing to do so, but a substantial minority never learn what the investigation concluded — removing the feedback loop through which an incident becomes shared organisational knowledge.[41]

Table no 5: Descriptive statistics on incident reporting and investigation.

Statement	Highly agree	Agree	Somehow agree	Disagree	Highly disagree
Accident frequencies are very high in my organisation every month	12	9	6	81	113
The incident reporting and investigation procedure is understood by me	97	101	8	7	8
Incidents are investigated and employees' views consulted	70	83	22	25	21
Incident investigation outcomes are shared with all employees to prevent similar occurrences	65	77	18	26	35
Employees are encouraged to suggest improvement opportunities after an occurrence	67	80	21	27	26
Employees are not penalised when they become casualty to an accident	93	37	6	13	12
The success of safety and health management in my organisation is because of effective incident investigation	60	71	23	31	36

Source: Field data (2025). Item totals are 221 except the non-penalisation item, for which 161 valid responses were recorded; percentages reported in the text are computed on valid responses per item.

Hazard knowledge, risk assessment and enforcement provisions:

Table 6 reports the adequacy and enforcement items. Task-level hazard knowledge was high: 191 respondents (86.4%) understood the risks associated with their own work, 186 (84.2%) considered the hazards identified during risk assessment relevant to their workplace, 192 (86.9%) confirmed that high risks are prioritised as recommended by workers, 185 (83.7%) confirmed awareness-raising on risk assessment and 178 (80.5%) confirmed consultative risk assessment.

The institutional and enforcement items were markedly weaker. Effective inspection for hazard identification was confirmed by only 118 respondents (53.4%) and denied by 75 (33.9%). Periodic hazard tours by the safety and health committee were confirmed by 115 (52.0%), with 58 (26.2%) disagreeing — a finding of consequence, since the committee is the statutory vehicle through which employees are represented. Freedom to raise any safety issue was confirmed by 136 (61.5%), leaving 39 (17.6%) who did not feel able to do so. The weakest item in the study was communication of inspection results: only 82 (37.1%) agreed that findings reach

all persons, while 111 (50.2%) disagreed or highly disagreed. Management correction of identified hazards was confirmed by 129 (58.4%) and review of risks following incidents by 112 (50.7%). The pattern is consistent: employees know the hazards of their own task well but know the institutional machinery of the Act — committee activity, inspection, feedback and review — considerably less well.[40,42]

Table no 6: Descriptive statistics on hazard identification, risk assessment and enforcement provisions (n = 221).

Statement	Highly agree	Agree	Somehow agree	Disagree	Highly disagree
Workplace inspection for hazard identification is effectively carried out	57	61	28	39	36
We are usually involved in identifying hazards at our workplace	65	68	53	17	18
The health and safety committee moves around to check workplace hazards periodically	54	61	48	31	27
Any person is allowed to raise any issue which may contribute to risk to workers	71	65	46	21	18
The result of the workplace inspection is communicated to all persons	43	39	28	51	60
The management corrects the hazards identified	69	60	56	14	22
Safety and health management success is because of effective hazard identification	69	62	43	24	23
I understand the workplace risks associated with my work	101	90	12	8	10
The organisation has created awareness on risk assessment for all persons	98	87	13	9	14
Risk assessment is done through consultation with the employees	90	88	10	18	15
Hazards identified during risk assessment are relevant to our workplace	99	87	16	7	12
High risks are given priority as recommended by workers	102	90	6	13	10
Risks are reviewed when incidents arise in the course of time	55	57	60	20	32

Source: Field data (2025).

Predictors of the status of occupational safety and health:

Regression results are given in Table 7 and illustrated in Figure 4. Each predictor was significant when entered singly: hazard exposure returned $\beta = 0.45$ ($p = 0.012$, $R^2 = 0.32$), occupational safety and health practices $\beta = 0.62$ ($p = 0.003$, $R^2 = 0.48$) and employee awareness of hazards $\beta = 0.58$ ($p = 0.005$, $R^2 = 0.41$). The combined model returned $\beta = 0.71$ ($p = 0.001$) with $R^2 = 0.65$ and adjusted $R^2 = 0.63$, indicating that the three predictors together account for approximately 65% of the variance in the status of occupational safety and health; the adjusted value remains close to the unadjusted one, so the fit is not an artefact of the number of predictors. Analysis of variance confirmed model significance ($F = 15.00$, $p < 0.001$; Table 8), with between-group variation substantially exceeding within-group variation.

The practical significance lies in the ordering. Awareness is a stronger predictor than hazard exposure: what employees know about the hazards of their workplace bears more heavily on safety status than the raw hazard load. Since hazard exposure in a depot is largely fixed by the nature of the product, the finding directs attention to the two predictors amenable to management action — practices and awareness.

Table no 7: Regression analysis of the relationship between the status of occupational safety and health and the predictor variables.

Model	Independent variable	Coefficient (β)	p-value	R^2	Adjusted R^2
Equation 1	Hazards in petroleum depots (X_1)	0.45	0.012	0.32	0.30
Equation 2	OSH practices in petroleum depots (X_2)	0.62	0.003	0.48	0.46
Equation 3	Employee awareness of hazards (X_3)	0.58	0.005	0.41	0.39
Equation 4	Combined (X_1, X_2, X_3)	0.71	0.001	0.65	0.63

Source: Field data (2025).

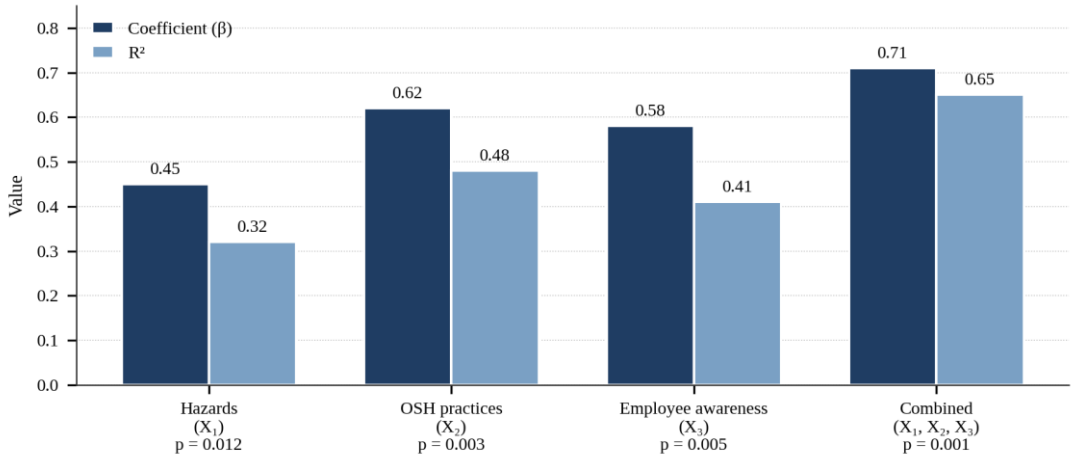

Figure no 4: Regression coefficients and coefficients of determination across the four fitted models.

Table no 8: Analysis of variance (ANOVA) results for the combined model.

Source of variation	Sum of squares	Degrees of freedom	Mean square	F-value	p-value
Between groups	1200	3	400	15.00	0.000
Within groups	800	20	40	—	—
Total	**2000**	**23**	—	—	—

Source: Field data (2025).

Perceived contribution of knowledge mechanisms to accident reduction:

Respondents rated the contribution of three knowledge mechanisms to accident reduction (Table 9, Figure 5). Training was rated the strongest contributor, with 193 of 221 respondents (87.3%) placing it in the two highest categories, followed by risk assessment with 167 (75.6%). Incident investigation was rated markedly lower and its distribution was polarised: 142 responses (52.0%) fell in the two highest categories but 100 (36.6%) in the two lowest. This is the fault line already visible in Table 5 — employees value the mechanism they are included in and discount the one whose outcomes they never see. Investigation is not judged ineffective in principle, but where its findings do not return to the workforce.

Table no 9: Perceived contribution of knowledge mechanisms to accident reduction.

Factor	1 Very slightly contributes	2 Slightly contributes	3 Somehow contributes	4 Highly contributes	5 Very highly contributes
Safety and health training	6	8	14	92	101
Incident investigation	52	48	31	65	77
Safety and health risk assessment	17	13	24	78	89

Source: Field data (2025). Row totals are 221 for training and risk assessment and 273 for incident investigation; percentages are computed on the row total for each factor.

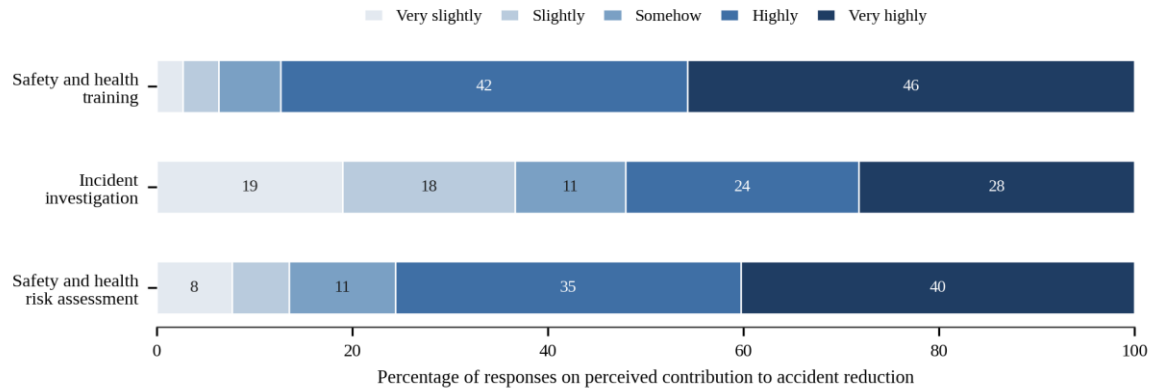

Figure no 5: Perceived contribution of training, incident investigation and risk assessment to accident reduction.

Key-informant perspective:

Both regulatory informants read the pattern in similar terms. The first observed that although there was a general perception of safety, accident reporting appeared insufficient, and that gaps in communication and awareness pointed to a need for reinforcement rather than new rules. The second noted that annual training contributed to a safety culture but should align more closely with each depot's actual hazards and employees' expressed needs, and that supervisory coaching, toolbox talks and internal training required strengthening. Both linked improvement to standardised inspection, better communication of findings and more proactive management response rather than to increased statutory obligation.

IV. DISCUSSION

The central finding is that knowledge of OSHA 2007 among petroleum depot employees is neither uniformly high nor uniformly low but stratified by type. Procedural and task-level knowledge is strong: employees understand the reporting procedure (89.6%), understand the risks of their own work (86.4%) and know that hazards should be reported (80.5%). Institutional and participatory knowledge is weak: barely half confirm effective inspection (53.4%) or committee hazard tours (52.0%), fewer than half report supervisory coaching (43.4%) or routine toolbox talks (43.9%), and only 37.1% confirm that inspection findings are communicated to all persons. The Act's preventive design depends on the second category at least as much as the first, because it is through committees, inspection, feedback and review that individual knowledge becomes collective control.[1,2]

This stratification explains a result that would otherwise appear contradictory. Nearly 95% of respondents denied monthly accidents while nearly 88% affirmed that fatal accidents had occurred in their depot within five years. Severe events cannot be concealed; minor injuries, spills and near misses can be, and are, absorbed into the routine of work. The literature on major-accident indicators holds that precursor events accumulate visibly before a serious loss,[4] and studies of downstream oil operations attribute much of safety performance to whether the workforce reports and escalates such precursors.[5] Where employees know that accidents must be reported but not that a dangerous occurrence without injury is itself reportable, the system captures the events that would have been captured anyway and loses the leading indicators that would have permitted intervention. The low reported frequency here is better read as a measure of reporting threshold than of hazard.

The regression results locate the leverage precisely. Employee awareness predicted the status of occupational safety and health more strongly than hazard exposure ($\beta = 0.58$ versus $\beta = 0.45$), and the three predictors jointly explained 65% of variance. In an installation storing bulk flammable product, hazard exposure is close to irreducible; awareness and practice are not. The ordering is consistent with international evidence that participatory programmes lower injury rates independently of the underlying hazard profile,[12,13,14,15] all such systems operating by converting workforce knowledge into workforce action, and with meta-analytic work finding that perceptions of organisational commitment to safety predict safety behaviour and outcomes across sectors.[27]

Three deficits merit attention. The first is supervisory coaching, the only item on which disagreement exceeded agreement. The supervisor is the point at which statutory requirement meets the actual task, and coaching in the flow of work is how abstract provision becomes situated knowledge; research on feedback and coaching indicates that periodic classroom instruction is a poor substitute.[39] Where 47.5% of employees report no such coaching, the chain from statute to task is broken at its last link. The second is the communication of inspection results. Inspection that is not fed back produces a record for the regulator and no knowledge for the workforce; analyses of inspection reports show that corrective value depends on whether findings reach the persons exposed,[40] and studies of safety communication identify feedback as the mechanism converting a finding into changed practice.[41] The third is the uneven functioning of safety and health committees, confirmed by only about half of respondents despite their statutory basis. Retrospective analyses of mining safety reports associate committee activity and standardised inspection protocols with measurable improvement,[42] and the committee is the only route by which lower-cadre employees hold a formal voice in depot safety decisions.

It is notable that consultative risk assessment performed well (80.5%) while consultation on training needs did not (51.1%). Depots have institutionalised employee input where a documented statutory output is required and a competent person signs it off, and have not done so where the requirement is more diffuse — the signature of compliance-driven rather than knowledge-driven practice, matching the wider finding that formal adoption of these duties tends to outpace operational implementation.[19,20] The polarised rating of incident investigation reinforces the point. Evidence on active learning indicates that participation is not merely motivational but improves retention of safety knowledge,[37] and work on continuous improvement finds sustained involvement to be a precondition for the durability of any training gain.[38]

Two limitations qualify these findings. The design is cross-sectional, so the associations cannot establish causal direction: depots with better outcomes may invest more in awareness rather than awareness producing the outcome. Second, knowledge was measured by self-report on agreement scales rather than by direct testing against the text of the Act, and self-reported safety perceptions are susceptible to social-desirability bias.[35] The high

procedural scores may therefore overstate substantive knowledge — the observation that employees affirm the reporting duty while applying a high reporting threshold is itself consistent with this. Future work should test knowledge of specific provisions directly and triangulate self-reported frequency against depot registers and the Directorate's notification records.

V. CONCLUSION

Employees in Mombasa County's petroleum depots hold sound procedural knowledge of their reporting duties and of the hazards attached to their own tasks, but distinctly weaker knowledge of the participatory and enforcement architecture through which OSHA 2007 is intended to operate. Knowledge that stops at the reporting rule produces compliance without engagement: the coexistence of near-universal denial of routine accidents with widespread affirmation of fatal events indicates that the reporting threshold, not the hazard level, is what the low frequency figures measure. Employee awareness was a stronger predictor of occupational safety and health status than hazard exposure itself, and the three predictors together explained 65% of the variance, confirming that the tractable levers are knowledge and practice rather than the intrinsic riskiness of the product.

Four measures follow. Training curricula should carry explicit statutory content — the duties of occupiers and employees, the composition and function of safety and health committees, the definition of a reportable dangerous occurrence and the notification pathway — and should be audited on knowledge demonstrated rather than attendance recorded. Feedback of inspection and investigation findings to all exposed employees should become a standing requirement with a defined timeframe, since this was the weakest provision measured. Supervisory coaching should be treated as a defined competency for which supervisors are trained and held accountable, the supervisor being the last link between statutory provision and the task as performed. Safety and health committees should be reactivated where dormant, with published membership, scheduled hazard tours and minuted follow-up, and the Directorate should verify committee function during audit rather than its existence on paper. Further research should test statutory knowledge directly, validate self-reported frequency against notification records, and evaluate whether digital hazard reporting measurably lowers the reporting threshold in this sector.

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REFERENCES

[1] Republic of Kenya. Occupational Safety and Health Act, No. 15 of 2007. Nairobi: Government Printer; 2007.
[2] Republic of Kenya. The Factories and Other Places of Work (Safety and Health Committees) Rules, 2004, Legal Notice No. 31. Nairobi: Government Printer; 2004.
[3] Narayanan DK, Ravoof AA, Jayapriya J, Revathi G, Murugan M. Hazards in oil, gas and petrochemical industries. In: Crises in Oil, Gas and Petrochemical Industries. Elsevier; 2023. p. 71–99.
[4] Zhen X, Vinnem JE, Han Y, Peng C, Huang Y. Development and prospects of major accident indicators in the offshore petroleum sector. Process Safety and Environmental Protection. 2022;160:551–562.
[5] Fabiano B, Pettinato M, Currò F, Reverberi AP. A field study on human factor and safety performances in a downstream oil industry. Safety Science. 2022;153:105795.
[6] Gichuki W. Petroleum Logistics in Kenya: Challenges and Opportunities. Nairobi: Research Press; 2021.
[7] Energy Regulatory Commission. Annual Report on Energy Trends and Safety Regulations. Nairobi: Energy Regulatory Commission; 2024.
[8] Zohar D, Luria G. The effects of group safety climate on accident frequency: a multilevel study. Journal of Safety Research. 2020;74:157–165.
[9] Mohammad MA, Siddiqui H. The impact of safety training on workplace safety behavior and accident reduction: a systematic review. Safety Science. 2021;134:105072.
[10] Bahn S. Worker participation in health and safety management: a review of the evidence. Safety Science. 2020;127:104706.
[11] Aarons GA, Dlugacz HR, Marsteller JA. The role of worker participation in organizational safety climate and safety outcomes. Journal of Safety Research. 2022;79:252–259.
[12] Cavalcante MC, Almeida R. Workers' participation in occupational safety: a study of Brazil and Chile. International Journal of Occupational Safety and Ergonomics. 2021;27(2):523–531.
[13] Gyekye SA. The influence of worker participation on workplace safety in the construction industry: evidence from the USA. Journal of Safety Research. 2020;75:229–235.
[14] Dahlgren G, Ahlberg M. Safety representatives in the European context: a comparative study of Sweden and Germany. Safety Science. 2021;141:105311.
[15] Bishop J, McCabe M, Roberts M. Understanding the role of safety representatives in reducing workplace injuries in Australia. Safety Science. 2022;147:105582.
[16] Yamamoto Y, Takeda K, Watanabe S. Kaizen and its impact on workplace safety: a study of Japan's manufacturing sector. Safety Science. 2022;144:105464.

[17] Kekana P, Makofane M, Ntlhane T. Enhancing safety management in the agricultural sector: a case study of workers' participation. Journal of Safety Research. 2023;83:120–128.
[18] Munyua PM, Njenga MK, Osoro EM, et al. Successes and challenges of the One Health approach in Kenya over the last decade. BMC Public Health. 2019;19:1–9.
[19] Salguero-Caparrós F, Pardo-Ferreira MDC, Martínez-Rojas M, Rubio-Romero JC. Management of legal compliance in occupational health and safety: a literature review. Safety Science. 2020;121:111–118.
[20] Hohnen P, Hasle P. The role of the European Agency for Safety and Health at Work in promoting OSH. Safety Science. 2020;128:104754.
[21] Lee J, Kim S. Comparative analysis of occupational safety and health legislation in Asia: challenges and opportunities. Safety Science. 2023;159:105086.
[22] Silva R, Lopez A. The impact of OSHA regulations on workplace fatalities in the United States: a retrospective analysis. Journal of Safety Research. 2022;79:47–57.
[23] Fishbein M, Ajzen I. Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research. Reading, MA: Addison-Wesley; 1975.
[24] Ajzen I, Fishbein M. Understanding Attitudes and Predicting Social Behavior. Englewood Cliffs, NJ: Prentice-Hall; 1980.
[25] Conner M, Sparks P. The theory of planned behaviour and health behaviours. In: Conner M, Norman P, editors. Predicting Health Behaviour. 2nd ed. Maidenhead: Open University Press; 2005. p. 170–222.
[26] Claxton G, Hosie P, Sharma P. Toward an effective occupational health and safety culture: a multiple stakeholder perspective. Journal of Safety Research. 2022;82:57–67.
[27] Griffin MA, Hu X, Barling J. Safety climate and safety performance: a meta-analytic review of the safety climate literature. Journal of Safety Research. 2021;76:129–140.
[28] González-Cañizalez Y, Sangacha-Tapia L, Manrique-Suarez R, Silva-Barreto J. IIoT trends in occupational safety and health: a perspective from text-mining data analysis. E3S Web of Conferences. 2024;532:02006.
[29] Ogunyemi S, Aiyedun A. Perceptions of occupational safety and health among workers in Nigeria: challenges and prospects. Journal of African Business. 2021;22(4):523–539.
[30] Bhat A, Gupta A. Workers' perceptions of occupational safety and health: a study in the context of informal employment in India. International Journal of Occupational Safety and Health. 2022;12(1):35–50.
[31] Owens L. The cross-sectional study: a review of its strengths and limitations. Journal of Research Practice. 2002;8(1):1–16.
[32] Cochran WG. Note on an approximate formula for the significance levels of z. The Annals of Mathematical Statistics. 1940;11(1):93–95.
[33] Creswell JW. Research Design: Qualitative, Quantitative and Mixed Methods Approaches. 4th ed. Thousand Oaks, CA: Sage; 2014.
[34] Field A. Discovering Statistics Using IBM SPSS Statistics. 5th ed. London: Sage; 2018.
[35] Wu MJ, Zhao K, Fils-Aime F. Response rates of online surveys in published research: a meta-analysis. Computers in Human Behavior Reports. 2022;7:100206.
[36] Zoeller KC, Gurney GG, Marshall N, Cumming GS. The role of socio-demographic characteristics in mediating relationships between people and nature. Ecology and Society. 2021;26:20–43.
[37] Minnick W, Cekada T, Marin L, Zreiqat M, Seal B, Mulroy J. The impact of active learning strategies on retention and outcomes in safety training. Creative Education. 2022;13(2):526–536.
[38] van Assen MF. Training, employee involvement and continuous improvement — the moderating effect of a common improvement method. Production Planning & Control. 2021;32(2):132–144.
[39] Atkinson A, Watling CJ, Brand PL. Feedback and coaching. European Journal of Pediatrics. 2022;181(2):441–446.
[40] Kekkonen P, Reiman A, Väyrynen S, Rajala HK. Occupational safety and health in shared workplaces according to workplace inspection reports. International Journal of Occupational Safety and Ergonomics. 2021.
[41] Narayan R, Nair VK. The roles of communicative language mechanisms in the occupational health and safety milieu in reducing workplace hazards. Journal of Language Teaching and Research. 2021;12(2):264–274.
[42] Tetzlaff EJ, Goggins KA, Pegoraro AL, Dorman SC, Pakalnis V, Eger TR. Safety culture: a retrospective analysis of occupational health and safety mining reports. Safety and Health at Work. 2021;12(2):201–208.
[43] Xu X, He Y. Blockchain application in modern logistics information sharing: a review and case study analysis. Production Planning & Control. 2024;35(9):886–900.
[44] Mugenda OM, Mugenda AG. Research Methods: Quantitative and Qualitative Approaches. Nairobi: Acts Press; 2003.