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An Investigation in to the Integrated Occupational Health, Safety and Risk Mitigation System Employed by the Indian Oil and Gas Industry

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Abstract: *This research addresses hazard identification, safety concerns, and management practices within the oil and gas industry. Activities such as well drilling and related operations often involve the use and generation of potentially hazardous substances. Oil and gas wells may release hydrogen sulfide, which poses a serious risk to workers by exposing them to toxic gases. To prevent injuries and fatalities, three key best practices are commonly recommended: continuous gas monitoring, effective planning, and comprehensive training programs for personnel. Workers in the oil and gas industry who are exposed to chemicals used or produced during operations may suffer from occupational illnesses affecting the lungs, skin, and other organs, depending on the level and duration of exposure. Prolonged exposure to high-risk environments may also lead to noise-induced hearing loss. Additional hazards include confined spaces, which can pose serious risks or even be life-threatening, especially for untrained personnel. The primary goal of occupational safety and health risk management is to identify and evaluate potential safety and health hazards in the workplace and to establish appropriate control measures and response strategies. Risk management refers to a systematic and interactive process involving a series of steps that, when followed in sequence, support continuous improvement in decision-making. The main objective of risk management is to establish a shared understanding among all stakeholders about the nature of risks and how they will be managed to enhance performance, increase organizational value, and reduce financial distress. In this study, both primary and secondary data sources were utilized for analysis. The research identified several risks facing the Indian oil and gas industry, including fluctuations in global oil prices, currency depreciation against major international currencies, health and safety concerns, political interference, environmental pollution, brain drain, shortages of crude oil, heavy debt resulting from government subsidies on petroleum products, defaults by oil marketing companies, and high operational risks. While the industry has incorporated risk management into its strategic planning and established audit and risk management departments, it continues to struggle with effective implementation.*

Keywords: Occupational hazards, petroleum and gas industry, audit and compliance, real-time monitoring, health risk management, occupational safety and health (OSH), and associated safety protocols and measures

I. INTRODUCTION

Large-scale oil and gas companies have made significant progress over the past decade by adopting more rigorous approaches, placing greater emphasis on both personal and process-related health and safety programs, and improving risk management practices. As a result, overall performance has notably improved compared to the past. However, achieving the ultimate goal of "zero harm" remains elusive in many areas, as health and safety performance has plateaued in recent years.

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Safety and risk management strategies:

Safety hazards and risks exist for all intents and purposes all over the place. When you stop and consider it, probably the most serious risk you take every single day is venturing outside of your front entryway. From fender benders to slips and falls, there are a bunch of potential safety hazards looking out for you and most happen all of a sudden. Accordingly, you likely convey medicinal and extra security. In case you're an entrepreneur, shouldn't you additionally be in acknowledgment of safety management for yourself, your workers, and clients? The following are three safety and risk management techniques that your organization can actualize to conceivably diminish mischief to workers and clients:

Safety and health management systems:

Regularly, risk appraisal and all sorts of avoidance and control measures are installed in the management procedure scene or in management frameworks. OSH management frameworks get from the Total Quality Management approach, explicitly those with Quality Management Systems as per the ISO 9000 standard. The technique depends on the 'Deming cycle', which comprises of an iterative procedure of four stages, known as 'Plan, Do, Check and Act (POCA)'. The contribution of top management in all means of the procedure is basic for a powerful management framework. Risk appraisal is the most significant in the 'Plan' arrange. The preventive and restorative allots ought to be conveyed under support of workers ('Do'). Execution measures and restorative and preventive activity are the quintessence of 'Check'. 'Act' revolves around the management survey, considering OSH execution measures. The most widely recognized standard for safety and health management frameworks is OHSAS 18001. In 2001, the International Labor Organization (ILO) likewise distributed OSH MS Guidelines. As of late, the methodologies were expanded by including health perspectives. For instance the World Health Organization (WHO) distributed a model for 'healthy working environments' with has a considerable lot of the qualities of an OSH MS. The British Standards Institute (BSI) has built up an openly accessible standard for the management of psychosocial risks, which can be viewed as an enhancement to the OHSAS 18001 standard.

Chain of command of anticipation and control measures

Risks ought to be maintained a strategic distance from/disposed of and (if unrealistic) decreased by taking deterrent measures, arranged by need. The request for need is otherwise called the chain of importance of control. There various chains of command of aversion and control estimates which have been created by various foundations. Regular are five stages in the progressive system of control in understanding to the BS OHSAS 18001 management framework.

The five stages are:

Stage 1 Elimination: Elimination of hazards alludes to the all-out evacuation of the hazards and subsequently adequately making all the distinguished potential mishaps and sick health outlandish. The term 'disposal' implies that a risk is diminished to zero without a moving it somewhere else. End is the perfect target of any risk management. This is a changeless arrangement and ought to be endeavored in the principal occurrence. On the off chance that the danger is

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expelled, the various management controls, for example, work environment monitoring and observation, preparing, safety reviewing, and record keeping will never again be required.

Stage 2 Substitution: Substitution means supplanting the peril by one that introduces a lower risk. The end is quickly joined with a move to another yet much lower risk. Frequently or more often than not suspected of with regards to synthetic concoctions, the idea of 'supplanting the risky by the non-hazardous or the less perilous' can be connected substantially more broadly; and highlights as one of the focal principles of the succession of deterrent estimates typified in the EC 'System Directive' (Directive 89-391-EEC). With synthetic compounds, substitution with a more secure type of a similar concoction, as opposed to supplanting the concoction may offer a reasonable, more secure choice (for example pellets as opposed to powder).

Stage 3 Engineering Controls: Engineering controls are physical implies that breaking point the peril. These incorporate basic changes to the workplace or work forms, raising a hindrance to interfere with the transmission way between the specialist and the danger. Neighborhood exhaust ventilation (LEV) to control risks from residue or smoke is a typical model' as is partition of the peril from administrators by strategies, for example, encasing or guarding hazardous things of hardware/gear. Need ought to be given to measures which ensure altogether over individual measures.

Stage 4 Administrative Controls: Also known as authoritative estimates managerial controls diminish or take out presentation to a danger by adherence to techniques or guidelines. Documentation ought to accentuate every one of the means to be taken and the controls to be utilized in completing the action securely. Especially in regard of more youthful workers, online networking is of developing significance as a road for spreading safety messages and other data identifying with occupational safety and health. Improving the versatility of workers through measures, for example, work environment health advancement can likewise be a helpful part of an all-encompassing way to deal with anticipation and control.

Stage 5 Personal Protective Equipment (PPE): PPE ought to be utilized distinctly if all else fails, after all other control measures have been considered, or as a transient possibility during crisis/upkeep/fix or as an extra defensive measure. The achievement of this control is subject to the defensive hardware being picked accurately, just as fitted effectively, worn consistently and kept up appropriately.

Problem statement

In the safety culture, mishap examination more often than not centres around administrator failures or on specialized disappointments and overlooks the board and fundamental variables. Human mistake is a manifestation of a safety issue, not a reason. All conduct is affected by the unique situation or framework in which it happens. Lessening administrator mistake requires taking a gander at such things as the structure of the hardware, the handiness of the working strategies gave, and the presence of objective clashes and generation weights. Advising individuals not to commit errors, terminating administrators who make them, or doing whatever it takes not to commit errors that emerge from the plan of the framework is vain. Accidents are mind boggling forms and misrepresenting causation prompts future Accidents brought about by those issues that were never distinguished or fixed after the past misfortunes. Here

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and there significant reasons for accidents are recognized or issues distinguished during performance reviews, yet the data is never adequately used to update the social and physical segments of the framework.

Need for the research

Customarily, safety has been viewed as a system part disappointment problem. Anticipating accidents than just requires making every individual segment entirely dependable. This methodology, notwithstanding, distorts the mishap procedure and can't avert accidents made by cooperation's among parts that have not fizzled. Another, frameworks way to deal with accidents rather believes safety to be a control problem. In this origination, accidents result from an absence of requirement of imperatives on safe conduct did not control the arrival of charge gas in industry the safety and health isn't secure. The structure and task did not sufficiently control the arrival of oil and gas in industry. The financial system did not satisfactorily control the utilization of risky financial instruments in our on-going financial emergency. Conduct safety limitations are upheld by the safety control structure of the organization or industry.

Risk management in the oil and gas industry

Although air is a mixture of gases, its composition remains relatively stable, allowing it to be treated as a single gas for simplifying the assessment of toxic and flammable gases in health and safety contexts. In the oil, gas, and petrochemical industries, hazards related to combustible and toxic gases are generally well understood by operators, technicians, and safety personnel. However, continuous training and knowledge updates are essential to prevent incidents caused by complacency. New employees are often assigned tasks in potentially hazardous areas with minimal training on gas-related risks and the proper use of gas detection equipment. It's important to note that most organic compounds are flammable. Consuming is a straightforward concoction response wherein oxygen from the environment responds quickly with a substance, creating heat. The least complex natural mixes are hydrocarbons, which are the principle constituents of raw petroleum and gas. Hydrocarbons are made out of carbon and hydrogen, the most straightforward hydrocarbon being methane, every particle of which comprises of one carbon iota and four hydrogen molecules. It is the principal compound in the family known as alkanes. The physical properties of alkanes change with expanding quantities of carbon particles in the atom: those with one to four being gases, those with five to ten being unpredictable fluids, those with 11 to 18 being heavier fuel oils and those with 19 to 40 being greasing up oils. Longer carbon chain hydrocarbons are tars and waxes.

When hydrocarbons burn, they react with atmospheric oxygen to produce carbon dioxide and water. However, if combustion is incomplete due to insufficient oxygen, carbon monoxide may also be formed. More complex organic compounds often contain elements such as oxygen, nitrogen, sulfur, chlorine, bromine, or fluorine. When these substances burn, the combustion products will include various other compounds. For example, materials containing sulfur, like oil or coal, will produce sulfur dioxide, while those with chlorine—such as methyl chloride or polyvinyl chloride (PVC)—will generate hydrogen chloride.

In most mechanical situations where there is the risk of blast or fire as a result of the nearness of combustible gases or vapours, a blend of mixes is probably going to be experienced. In the oil, gas and petrochemical ventures the crude materials are a blend of hydrocarbons and synthetic concoctions, some of which might be adjusted by a procedure. For instance raw petroleum is isolated into numerous materials utilizing procedures alluded to as fractionation (or fragmentary refining), parts are additionally changed over utilizing procedures, for example, 'splitting' or 'reactant improving'. Combustible hazards are in this way prone to be spoken to by numerous substances on a commonplace petrochemical refining plant.

Strategies engaged with Identifying Hazard

- Hazard and Operability study (HAZOP)
- Failure Mode and Effective Analysis (FMEA)
- Quantitative Risk Assessment (QRA)
- Event Tree Analysis (ETA)
- Fault Tree Analysis (FTA) HOZOP AND ITS IMPACTS

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Risk and Operability (HAZOP) Study is an organized and methodical assessment of an arranged as well as existing activity to recognize and assess potential hazards in structure and activity. This investigation is done by a group of specialists from various controls. The group takes a gander at each area of a plant or framework or activity (hub), considers potential deviations from planned activity and investigations their outcomes against any current protections. Effect of recognized hazards on safety, resource and condition are surveyed. HAZOP is a guideword driven conceptualizing method. Colleagues contribute dependent on their aggregate understanding and exercises gained from past ventures. HAZOP study records the recognized hazards without proposing any arrangement, except if an answer is self-- evident proposed arrangements may incorporate extra protects or operational systems as fundamental. The examination record fills in as a manual for decide the Health, Safety and Environment (HSE) issues to be settled during the venture.

Following are key exercises of SH&E:

- Security of property and Personnel
- Operational Safety
- Safety Audit Programs
- Product Knowledge
- Incident/Accident/Near Misses examination for underlying driver investigation
- Emergency Response and File Protection.
- Environmental security
- Safety, Training, Health records.

II. LITERATURE REVIEW

Risk management practices in oil and gas industry India.

Risk management enhances a firm's value and can help reduce financial distress. In the oil and gas industry, worker health and safety pose significant risks. Disruptions in oil production caused by fires and accidents often result in major financial losses and present serious threats to both people and the environment (Ablang, 2005). Wilson and Shlyakter (1997) explored the concept of risk and its roots in uncertainty. They identified various forms of uncertainty and, as part of their review of risk assessment methods, examined error theory—concluding that such errors are a critical component in any probabilistic risk analysis.

Risk management theories.

Financial way to deal with corporate risk management has so far been the most productive as far as both hypothetical model expansions and observational research. This methodology expands upon great Modigliani,- Miller and Modigliani (1958) worldview which states risk management hypothesis discovers conditions for superfluity of monetary structure for collaborate esteem. This worldview was later reached out to the field of risk management. This stipulates supporting prompts lower unpredictability of firm worth. Method of reasoning for corporate risk management were led from the insignificance conditions and finished up, higher obligation limit. (Mill operator and Modigliani, 1963), Sarewitz, Pielke, and keykhah, (2003) contended for a distinction between occasion risk and result risk.

Development of occupational health in India.

Improvement of occupational health in India pursued the example in other creating nations. Initially, the primary occupation was mechanized farming and creature cultivation. The workforces were primarily ladies and youngsters. Instalment for work was not known. Workers were presented to numerous kinds of health hazards. Treatment at that point was not composed. Afterward, producing including development appeared. Current occupational health, detailed (Achalu, 2000) began because of colonization and industrialization by Britain. The principal occupational health benefits in India was presented by the Medical Examination Board of Liver pool Inferminary in 1789 with the principle point of thinking about the health of British slave vendors from Africa to Britain. Be that as it may, after the nullification of slave exchange, the Royal Niger Company of Britain expanded its investigation and exchanging exercises India. The Company sorted out its very own health administrations which were later acquired by the United

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African Company (UAC). During the British frontier rule, huge numbers of their fighters were biting the dust of intestinal sickness. This drove Colonel Lugard to set up health administrations to deal with the health and welfare of fighters and other frontier directors. Afterward, during the Second World War, the Medical Corps was isolated to provide food for the military alone prompting the making of Public Health Service which turned into the core of the National Health Service. After the world war, numerous businesses began developing boss among them were development of rail lines and coal mining. This pulled in work of numerous Labourers particularly youngsters.

III. RESEARCH METHODOLOGY

Health, safety and risk management stages:

The Issue Stage refers to situations where risk identification is not effectively carried out. This stage is characterized by poor communication, leading to a lack of coordination. At this point, crisis management is employed to handle the existing problems. The Alleviation Stage marks the transition from crisis management to risk management. At this point, individuals begin to recognize risks but do not address them in a structured manner. There is also uncertainty about how to effectively communicate these risks. Counteractive action Stage discusses the move of risk management as exclusively a chief's action to risk management as a group action. This is a value-based stage from shirking of risk indications to distinguishing proof and disposal of main driver of risks, described by group, and some of the time client, contribution. For risk management to succeed it must happen at each level inside an association. This stage speaks to a defining moment from a responsive to an increasingly proactive way to deal with risk management.

Expectation Stage describes the move from emotional to quantitative •risk management, using measures to envision unsurprising risks that is portrayed by the utilization of measurements to foresee disappointments and anticipate future occasions. This stage includes the capacity to gain from, adjust to, and envision change, speaking to a totally proactive way to deal with risk management. The Opportunity Stage represents a forward-looking approach to risk management, aimed at enhancing and shaping the future. Risks are viewed as opportunities to save money and achieve better-than-expected outcomes. Similar to quality, risk management is considered everyone's responsibility. It involves an ongoing process of identifying, communicating, and resolving risks in a transparent and non-threatening environment. The organization accepts that some uncertainties exist and accommodates them by considering best-case and worst-case scenarios.

Research methodology

The research would not have been cultivated effectively without depending on significant data. We depended on two wide collection techniques which were spellbinding in nature. The research method was qualitative and quantitates data. The essential data was accumulated through the organization of questionnaires to staff and the board of oil industry just as Interviews led. Two arrangements of questionnaires were intended for the executives and representatives of Oil and gas industry. 100 questionnaires were controlled to top administration and representatives at oil and gas industry. Out of this, questionnaires were recovered from the executives and representatives individually for better outcomes in health and safety.

Sources of data

The oil and gas industry in India does not do not have the mastery to lead the risk supervisory group. They anyway stated that there are boundaries in actualizing risk the board arrangements in health and safety. They expressed trouble from staff since they don't Comprehend the procedure of safety methodology the board have embraced to oversee risk. Representatives subsequently neglect to conform to risk the board systems and spurn safety rules without risk of penalty. So we gather the primary data and secondary data in the oil industry to know how the workers and directors are dealt with dependent on health, safety.

Sampling

A standout amongst the most essential components to ensure information is to have an undertaking information security engineering connected to every one of the data, frameworks, procedures, and individuals. It is basic to have the option

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to follow from the business procedure to singular security technologies. By along these lines we gather the examples dependent on methodology and tossed the inquiries towards the representatives and the executives plainly a territory of activity for the industry, security, and risk taken by them.

IV. DATA ANALYSIS AND DISCUSSION

Sr.No.	Table 5.1: Education level of respondents	
1	Particulars	Percentage
	Medium school	0
	High school	3
	Graduate	29
	Higher graduate	68
	Total	100
2	Table 5.2: Age range of responds	
	Particulars	Percentage
	<20	3
	21-30	27
	31-40	41
	41-50	25
	>50	4
	Total	100
3	Table 5.3: Sex of responds	
	Particulars	Percentage
	Male	80
	Female	20
	Total	100
4	Table 5.4: Health hazards in oil and gas industry workers	
	Particulars	Percentage
	Physical	16
	Chemical	4
	Ergonomic	28
	Biological	27
	Psychosocial	25
	Total	100
5	Table 5.5: Responds given when managing risks	
	Particulars	Percentage
	Management	35
	Employees	65
	Total	100
6	Table 5.6: Control measures taken for health, safety and risk management	
	Particulars	Percentage
	Yes	78
	No	22
	Total	100

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Table 5.7: Management Assessment for oil and gas industry

Number of responds						
Risks	Critical	High	Moderate	Low	Very low	Management risk Index
Instability in global oil prices	1	2	0	0	0	1.20
Depreciation of the dollar against major currencies in India	1	2	0	0	0	1.20
Health & safety	4	1	0	0	0	4.1
Credit risk-default	3	0	0	0	0	1.23
Theft	1	2	0	0	0	1.20
Political interference	1	2	0	0	0	1.20
Environmental risk	0	0	1	1	0	0.01
Shortage of crude oil	1	2	0	0	0	1.20
Risk of attack on Oil and gas facilities	0	0	1	1	0	0.01
Operational risk (Fire and breakdown of equipment)	3	1	0	0	0	3.10

Table 5.8: Employee's Assessment of Management for oil and gas industry

No of responds				
Risk	Excellent	Satisfactory	Unsatisfactory	Total respondents
Health & safety of employees	25	63	12	100
Default by OMC's to pay their debt	21	64	25	100
Environmental pollution	20	60	20	100
Theft in the refinery	23	61	16	100
Shortage of crude oil	13	15	72	100
Operational risk: Fire outbreak and breakdown of Equipment	28	46	26	100
Huge debt due to foreign exchange exposure	18	53	29	100
Reputation: Public critique	22	54	24	100
Political interference from the government	19	59	22	100

Table 5.9: Health and safety systems required to manage in the industry

Particulars	Percentage
Control and Distribute up-to-date Documents	37
Safety Inspection Checklists	26
Risk Assessments	63
Emergency Response Plan	28
Training Program and Documentation System	55
Internal audit Policy and Schedule	46
Laws and Health and Safety Regulations for Compliance	33
Measurable Performance Metrics	62
Regular Meetings and Communications Strategy	45
Regular Management Review	29

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Chart 5.7: Health and safety systems required to manage in the industry

Table No 5.11 Strengthening the management incurrence and implementing safety and health

Particulars	Mean	Significance
Lack of safety knowledge to implement proper safety measures as required	2.81	1.25
Clients should consider safety as one of the project success factors	4.12	1.03
Safety should be one of the criteria in tendering	4.14	1.45
Government should subsidise safety training for companies that meet requirements	3.98	1.42
Safety performance and compliance should be linked to insurance premium and licencing system	3.67	1.54
Government should enforce safety law and regulations effectively	3.56	1.29
Mandatory safety training should be more thorough and harder to pass	3.40	1.26
Companies should form a "safety responsible group" to share safety resources and to ensure that the each group member meets safety requirements	3.28	1.46
Government should explicitly tell small companies what to do to implement safety	2.89	1.91
Safety law and regulations should be less prescriptive to allow small companies to self-regulate safety	2.97	1.61
Harsher punishments or consequences to small companies that violate safety regulations	2.77	1.33
Worker unions should pressure companies to focus on safety	1.83	1.12
Mandatory safety training is impractical	2.15	1.08
Owners and employees of companies have other urgent and more relevant issues than safety	2.86	1.67

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IV. FINDINGS AND CONCLUSION

Finding

a. The survey conducted in the oil and gas industry revealed that 68% of the respondents had a higher graduate education, 29% held a graduate degree, 3% had completed high school, and 0% had a medium school level of education.

b. It is found that 31 - 40 age range given 41% of responds, 21 - 30 age range given 27% of responds, 41- 50 age range given 25% of responds, >50 age range given 4% of responds and <20 age range given 3% of responds when taken survey about oil and gas industry health, safety and risk management.

c. It is found that 80% of them were male responds when taken survey and 20% were female when taken survey for health, safety and risk management for oil and gas industry in India.

d. It is found that 28% were Ergonomic, 27% were Biological, 25% were psychosocial, 16% were physical, and 4% were chemical are the health hazards found in oil and gas industry workers affecting the health for them.

e. It is found that 65% responds given by employees when managing risks, and 35% responds given by management when managing risks in the oil and gas industry.

f. It is found that 78% responds as yes that control measures taken for health, safety and risk management in oil and gas industry and 22% responds as No that control measures did not taken for health, safety and risk management in the oil and gas industry in India.

V. CONCLUSION

a. Concentrating on health, safety and risk management among associations is critical to continue improving safety execution in the oil and gas industry in light of the fact that most of associations are oil and gas industry. Past research has advanced hindrances looked by associations to execute health, safety and risk management and has prescribed potential procedures to address the obstructions. This research has gathered information from the Oil and gas industry in India to distinguish the key obstructions and systems in this unique situation.

b. Maybe a couple of the mediations and even less of the assessments of those programs have tried their adequacy explicitly for workers. Besides, researches have not routinely included samples illustrative of the workforce of the future that will incorporate expanding extents of workers. Research has concentrated on a restricted arrangement of occupations and working environment conditions, and little is right now thought about those that will in the future be utilizing expanding extents of workers. For example, PC workstations have been presented in many occupation settings, but then there has been little assessment of the ampleness of their structure for clients. Such research can prompt the formation of guidelines and best practices that will prompt more secure, healthier, and increasingly profitable workplaces.

c. The outcomes demonstrate that all the key hindrances are outer variables, along these lines Industry have constrained to no power over them. Wild challenge supported by absence of safety duty from the customer and the utilization of most minimal offer cost to assess delicate entries powers oil and gas industry to decrease their expenses by whatever methods available, including ignoring safety. Because of the idea of the boundaries, the techniques to address them ought to likewise include outside partners; especially the government, customers, and huge Industries that really have the expected impact to change the standards and culture of the industry. For all intents and purposes, these techniques are examined in objectives including health and safety as a marker in delicate assessment, increasingly successful health and safety implementation by examination and connecting safety execution with protection premium and permitting framework, and sponsoring safety training for ventures, while likewise ensuring the adequacy of existing safety training programs.

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