

Compliance Evaluation of IOGP Life-Saving Rules Amongst Petroleum Industry Workers in Delta State, Nigeria

ANDREW M. ABANUM¹, IBIDABO D. ALABERE²,
PATRICKS E. CHINEMEREM³

¹SPDC, University of Port Harcourt - Nigeria.

²University of Port Harcourt - Nigeria.

³Center for Research, Environment Education & Development, Environment & Millennium Targets Ltd.

Abstract: Safety rules and procedures (SRPs) are integral part of safety management system designed to prevent incidents and ensure decent workplace. Life-saving rules (LSRs) are integral of SRPs and are popular in the oil and gas (O&G) industry. The International Association of Oil and Gas Producers (IOGP) in 2018 published a revised version of LSRs and recommended O&G industry to adopt, to foster common understanding and engender compliance across a multicultural and multilingual workforce. The introduction of IOGP LSRs greatly improved safety performance for companies that adopted them, but incidents revealed cases of non-compliances. A cross-sectional study was done to evaluate the level of workers awareness and compliance with IOGP LSRs and possible reasons for non-compliances. The study was conducted amongst 317 sharp end workers and selected leaders, recruited through a multistage sampling technique in selected O&G companies. The critical finding was a high awareness and compliance levels of 90.6% and 91.5% respectively with IOGP LSRs. The reasons elicited for non-compliances were: zeal to complete task on time, poor attitude to work, inadequate supervisory on compliance and unavailability of tools and personal protective equipment when required. Other reasons were poor intervention culture, lack of management commitment and poor safety culture in the organisation. Furthermore, error enforcing conditions, bureaucracy in seeking approvals, peer pressure inter alia were elicited as reasons for non-compliance with IOGP LSRs. Consequently, it is recommended from study findings that management of companies should strive to implement safety programmes that will engender workers awareness and compliance with SRPs, to achieve the goal of incident prevention. The study presents a proposed model for the management of SRPs in the workplace for the overall benefits of all stake holders.

Keywords: Safety Rules, Life-Saving Rules, Compliance, Oil and Gas Industry, IOGP, Incident Prevention.

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I. INTRODUCTION

The continuum of incidents has been closely linked with an increase in the rate of non-compliance with safety rules and breaches in safe work practices across many industries (Liang, Lin, Zhang, & Su, 2018; IOGP 2018a,b; Kvalheim & Dahl, 2016; van der Molen & Frings-Dresen, 2014). Non-compliance with safety rules and procedures has also, been pin-pointed as a key player in the occurrence of industry incidents across the world (IOGP 2018; Jones, Phipps, & Ashcroft, 2018; Wang, Gao, Ruckert & Jiang 2017; Kvalheim & Dahl, 2016; Daramola, 2014; Hopkins, 2011). Safety rules are critical and invaluable aspect of safety managements systems and are numerous, especially in high risk industries (Weichbrodt, 2015; Hopkins, 2011). The workplace setting is such that safety rules are complemented with required procedures (Brandhorst & Kluge, 2016) to ensure safety in the O & G industry, which is a core value (Alkhaldi, Pathirage & Kulatunga, 2017; Azuike et al., 2017; Awodele, 2014). Compliance with LSRs targets incident prevention, ensures energy security, propels the goal of creating a decent work and economic growth in line with No.8 of United Nations Sustainable Development Goals (UN-SDG). A standard template of safety rules has been developed the International Association of Oil & Gas Producers (IOGP) and is common in the O&G industry (IOGP, 2018; Walker, Hawkes, Poore & Carvalho, 2018; OGP, 2013; Walker, Sunderland, Fraser & Peuscher, 2012). According to IOGP (2018b) Report 459 between 2008 and 2017 (10years), a total of 376 fatalities in the oil and gas (O&G) industry could have been averted, if only life-saving rules were complied with. Many incidents in history occurring in the workplace have been attributed to human failures, which are either human errors or violations/non-compliance (Wang, Quin, Ruckert, & Jiang, 2017; Mathisen & Bergh, 2016; Dahl, 2013; Dahl & Olsen, 2013; Morris, 2012; Adams, 2006). In the pursuit of sustainable energy, securing of assets and decent workforce can be achieved via rule compliance and risk management, which are critical to the assurance of

safety in energy industry (Kouabenan, Nguetsa & Mbaye, 2015; Dahl & Olsen, 2013; Hopkins, 2011). Therefore, it is expedient to evaluate workers compliance with SRPs such as the IOGP life-saving rules, with a view to eliciting the level of compliance and perhaps gain insights for improvement of safety performance.

1.1 The IOGP Life-Saving Rules

The International Association of Oil & Gas Producers (IOGP) developed 18 Life-Saving rules (LSRs) (Figure 1), using selected criteria and data from reported incidents over a period. Incident data reported to IOGP with fatalities (1991-2010) and high potential events (2000-2010), were reviewed and it was found that 8 core rules applied to at least 40% of fatal incidents, while full set of the rules applied to at least 60% of the incidents. The multinationals, national, and business owners have adopted it to develop and tailor the rules as they apply to their businesses (OGP, 2013; Walker et al., 2012).

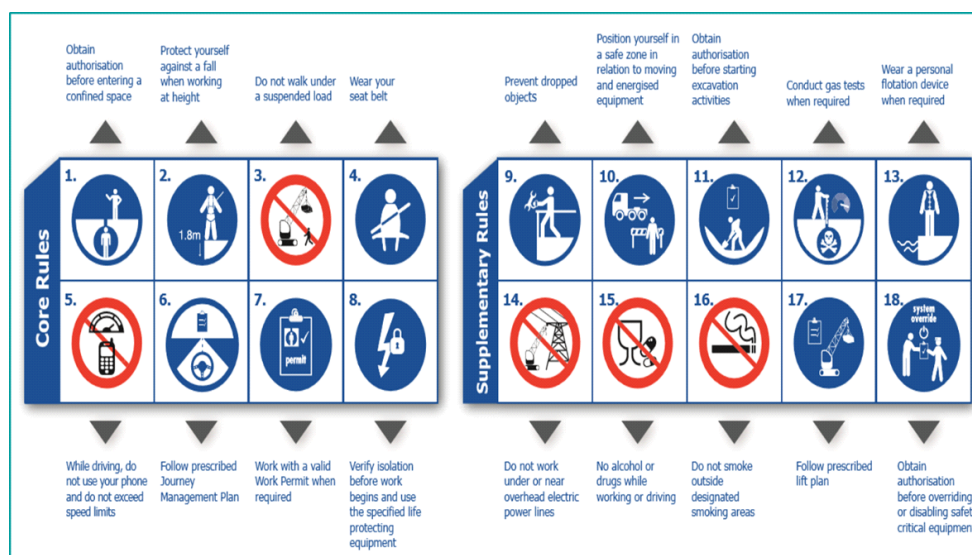


Figure 1: OGP Life-Saving Rules (OGP, 2013)

1.2 The Revised IOGP 9 LIFE-SAVING RULES (LSRs)

The revised version of IOGP LSRs (Figure 2) was published in August 2018 (IOGP, 2018b). This latest version now has Nine (9) simplified set of life-saving rules with corresponding icons. They are not different from the eighteen (18) published in version 2 of (OGP, 2013), but contains all rules in the 18 LSRs integrated and compressed into the present Nine (9). It comes with recommended actions necessary for industry workers to protect themselves and colleagues from fatalities. IOGP 9 LSRs aim is to standardize Life-Saving Rules across all O&G industry and address all risks and hazards in the industry. The objectives are to propagate common safety knowledge, share learning from incidents, LSRs awareness and integration of safety rules in all activities. The recommendation of IOGP is that all O&G companies should adopt the 9 life-saving rules, to achieve standardization of LSRs with uniformity across the O&G industry (IOGP, 2018b). According to IOGP (2013), all operating O&G companies are expected to have these LSRs and associated procedures in place as a minimum, to ensure safety in the work place.

<p>Bypassing Safety Controls</p> <p>Obtain authorisation before overriding or disabling safety controls</p> <ul style="list-style-type: none"> I understand and use safety-critical equipment and procedures which apply to my task I obtain authorisation before: <ul style="list-style-type: none"> disabling or overriding safety equipment deviating from procedures crossing a barrier 	<p>Confined Space</p> <p>Obtain authorisation before entering a confined space</p> <ul style="list-style-type: none"> I confirm energy sources are isolated I confirm the atmosphere has been tested and is monitored I check and use my breathing apparatus when required I confirm there is an attendant standing by I confirm a rescue plan is in place I obtain authorisation to enter 	<p>Driving</p> <p>Follow safe driving rules</p> <ul style="list-style-type: none"> I always wear a seatbelt I do not exceed the speed limit, and reduce my speed for road conditions I do not use phones or operate devices while driving I am fit, rested and fully alert while driving I follow journey management requirements
<p>Energy Isolation</p> <p>Verify isolation and zero energy before work begins</p> <ul style="list-style-type: none"> I have identified all energy sources I confirm that hazardous energy sources have been isolated, locked, and tagged I have checked there is zero energy and tested for residual or stored energy 	<p>Hot Work</p> <p>Control flammables and ignition sources</p> <ul style="list-style-type: none"> I identify and control ignition sources Before starting any hot work: <ul style="list-style-type: none"> I confirm flammable material has been removed or isolated I obtain authorisation Before starting hot work in a hazardous area I confirm: <ul style="list-style-type: none"> a gas test has been completed gas will be monitored continually 	<p>Line of Fire</p> <p>Keep yourself and others out of the line of fire</p> <ul style="list-style-type: none"> I position myself to avoid: <ul style="list-style-type: none"> moving objects vehicles pressure releases dropped objects I establish and obey barriers and exclusion zones I take action to secure loose objects and report potential dropped objects
<p>Safe Mechanical Lifting</p> <p>Plan lifting operations and control the area</p> <ul style="list-style-type: none"> I confirm that the equipment and load have been inspected and are fit for purpose I only operate equipment that I am qualified to use I establish and obey barriers and exclusion zones I never walk under a suspended load 	<p>Work Authorisation</p> <p>Work with a valid permit when required</p> <ul style="list-style-type: none"> I have confirmed if a permit is required I am authorised to perform the work I understand the permit I have confirmed that hazards are controlled and it is safe to start I stop and reassess if conditions change 	<p>Working at Height</p> <p>Protect yourself against a fall when working at height</p> <ul style="list-style-type: none"> I inspect my fall protection equipment before use I secure tools and work materials to prevent dropped objects I tie off 100% to approved anchor points while outside a protected area

Figure 2: Revised IOGP 9 Life-Saving Rules (IOGP, 2018)

II. STATEMENT OF PROBLEM

The workers in petroleum sector are constantly exposed to hazardous conditions and are involved in high risk activities, with likelihood for accidents (Adebola, 2014; Eyayo, 2014; Hopkins, 2011). The reason for the establishment of SRPs is to protect the workers and prevent incidents (Weichbrodt, 2015; Dahl, 2013; Adebola, 2014). To this intent, rule compliance and risk management are critical to assurance of safety in hazardous industry (Kouabenan et al., 2015; Dahl & Olsen, 2013; Hopkins, 2011). However, the rate of incidents is on the increase across many industries and the occurrences are not unconnected with established SRPs non-compliances (Jones et al., 2018; Wang et al., 2017; Kvalheim & Dahl, 2016; IOGP 2015, 2016, 2017, 2018). The continuum of non-compliance with SRPs and LSRs is a tell-tale that something is wrong. Consequently, it behooves researchers to establish the existence and accessibility of these SRPs and LSRs in the workplace, awareness level and understanding of the SRPs and LSRs, and to carry out compliance evaluation needful to determine whether gaps exist or otherwise.

2.1 Justification for the Study: Some researchers in Nigeria have studied the awareness, knowledge and attitude of workers with respect to application of general SRPs (Afolabi & Gbadamosi, 2017; Azuike et al., 2017; Adebola, 2014; Umeokafor et al., 2014; Aliyu & Saidu, 2011), but to the best of my knowledge, similar studies have not considered workers in the upstream sector of O&G industry, using a global standard set of safety rules and procedures. Hence, this study in the sector became imperative. Determination of workers awareness is important as well as probing if workers are complying, to what level, and if there are non-compliances, the reasons for not complying. We need total compliance with SRPs & LSRs to secure energy assets, keep workers safe and green environment.

2.2 Study Aim: The aim was to evaluate the level of compliance with safety rules and procedures (SRPs) among workers in petroleum industry in Delta State. The objectives of stated aim were to:

- I. Establish the existence of SRPs in selected O&G companies.
- II. Determine workers awareness level of SRPs.
- III. Determine the level of workers compliance with SRPs and with the 9 IOGP LSRs.
- IV. Elicit the reasons for non-compliance with SRPs if any or otherwise.

III. MATERIALS AND METHODS

3.1 Study Area: Delta State is a major oil producing state and ranks second to Rivers State in Nigeria. The State supplies about 35% of Nigeria's crude oil and some considerable amount of natural gas and, known as the business destination for national and multi-national O&G companies in the Niger Delta. Petroleum industry operating in Delta State are into exploration and production, processing, marketing, oilfield services and logistics inter alia (NigeriaGalleria, 2017a,b). The choice of Delta State is due to its strategic position in the Niger Delta and the landmark of major international and indigenous O&G companies within the state.

3.2 Study Design: A cross-sectional descriptive study was carried out amongst 317 sharp end workers and selected leaders, recruited through a multistage sampling technique (Nwaogazie, 2011; Creswell, 2009) in selected O&G companies in Delta State of Nigeria.

3.3 Study Population: The study population are personnel working in the 4 selected O&G upstream companies in Delta State. The 4 selected companies denoted by letters A, B, C and D have 1250 sharp end workers. The breakdown of staff strength is A = 600, B = 250, C = 280 and D = 120 This study was conducted amongst workers and selected leaders from the logistics department, core operations and maintenance staff and contractor staff. **Inclusion criteria:** Sharp end workers who have worked for 2 years or more in the oilfield upstream production operations.

Exclusion criteria: Excluded from this study are the company's senior management staff, staff of Safety and Environment (SE) department, workers unavailable at the time of study.

3.4 Sample Size Determination: Sample size estimation for the study was computed using the Cochran's formula (Nwaogazie, 2011), given as:

$$N_0 = \frac{Z^2 P(1-P)}{T^2}$$

where N_0 = sample size; Z = z-value (1.96) at confidence level value of 95%;

P = Prevalence of 78% (0.78) compliance with safe practices from similar study carried out by Adebola (2014) in Lagos State, Nigeria; T = tolerance error of 5%

Computed sample size is 264 from equation. To allow for non-response/invalid data 20% added to obtain 317 for the study.

3.5 Data Collection Instruments and Statistical Analysis Tools: Data was garnered with the aid of a self-developed checklist and semi-structured self-administered questionnaire. The checklist assessed the availability of LSRs as recommended by IOGP, while the questionnaire elicited information on SRPs awareness, socio-demography, occupational history and compliance evaluation questions on IOGP LSRs with provision for reasons where non-compliances occurred. Study instruments were pretested and validated before field work (Tsang, Royse & Terkawi, 2017; Bolarinwa, 2015). Data analysis applied descriptive and inferential statistics using the Statistical Package for Social Sciences (SPSS) version 22 application.

3.6 Ethical Consideration: Ethical approval was obtained from the University of Port Harcourt research ethics committee. Further approval for the study was obtained through a request letter from the department of petroleum resources (DPR) to the companies. Recruited participants were assured of confidentiality of information provided in line with research ethics.

IV. RESULTS

4.1 Response Rate: A total of 317 questionnaires were administered to study participants. Three hundred (300 copies) were retrieved, and after data cleaning, 288 copies were considered valid and useful for analysis and interpretation. Out of the 317 copies administered, 29 copies were not used due to unreturned (17) and void/incompletely filled (12). Response rate was 94.64% and 96% of data completeness was recorded.

4.2 Socio Demographics (Table 1): Respondents had mean age of 39.94 years with standard deviation of \pm 8.61 and 19 (6.6%) out of 288 respondents were aged less or equal 25 years, while 87 (30.2%) were aged

between 26 and 35 years, 114 (39.6%) respondents were aged between 36 and 45 years, 58 (20.1%) were between 46 and 55 years old, while 10 (3.5%) were 56 years and above. A total of 276 (95.8%) males and 12 (4.2%) females by sex. There were 60 (20.8%) singles, 225 (78.1%) married and 3 (1.0%) divorced /widowed. Two-hundred and 48 (86.1%) out of 288 respondents were Christians while 10 (3.5%) respondents were Islam and 30 (10.4%) indicated traditionalist/ other religion. Ninety-nine (34.4%) earned secondary education and 189 (65.6%) had acquired degrees in education tertiary. Technicians who participated in study were 202 (70.1%) while supervisors and engineers were 86 (29.9%).

Table 1: Socio Demographics

Socio-Demographics	Frequency (n=288)	Percentages (%)
Company		
A	136	47
B	59	21
C	64	22
D	29	10
Age (years)		
≤ 25	19	6.6
26 – 35	87	30.2
36- 45	114	39.6
46 – 55	58	20.1
≥56	10	3.5
Mean Age (39.94 years), Std.Dev. ± 8.61		
Sex		
Male	276	95.8
Female	12	4.2
Marital Status		
Single	60	21.0
Married	225	78.0
Divorced/ Widow/Widower/ Co-habitation	3	1.0
Religion		
Christianity	248	86.1
Islam	10	3.5
Tradition/Others	30	10.4
Highest Level of Education Completed		
Secondary/Technical	99	34.4
Tertiary	189	65.6
Highest Qualification		
O'Level	29	10.1
OND	57	19.8
HND	68	23.6
BSc/B.Tech	106	36.8
MSc/MEng/Ph.D	28	9.7
Role		
Technicians	202	70.1
Supervisors/Engineers	86	29.9

4.3 Workers Awareness: Tables 2&3 presents the awareness level results from the study. The Likert scale assessment had a criterion mean of 2.5 and with the grand mean of 3.58, it shows that workers have high awareness level of SRPs (Table 5). Furthermore, using bivariate analysis, analysis obtained workers high level of awareness (90.6%) aggregated under good awareness (Table 3) and 9.4% of poor awareness of SRPs in the workplace.

Table 2: Awareness of Safety Rules and Procedures

Statements (n=288)	SA (%)	A (%)	D (%)	SD (%)	Mean	Std.	Decision
Knowledge of safety rules and procedures around workplace.	215(74.7)	68(23.6)	2(0.7)	3(1)	3.72	0.53	Significant
Knowledge of the consequences of not following safety rules and procedures.	193(67)	93(32.3)	0(0)	2(0.7)	3.66	0.52	Significant
Can identify and recognize the required safety rules and procedures.	178(61.8)	103(35.8)	3(1)	4(1.4)	3.58	0.59	Significant
Always review and share information about safety rules and procedures before starting a job.	159(55.2)	110(38.2)	16(5.6)	3(1)	3.48	0.65	Significant
Ability to intervene if a co-worker violates safety rules and procedures.	152(52.8)	122(42.4)	10(3.5)	4(1.4)	3.47	0.63	Significant
Grand Total	897(62.3)	496(34.4)	31(2.2)	16(1.1)	3.58	0.59	Significant

Table 3: Summary of Awareness of SRPs Using the Means

Companies	Awareness Level of SRPs		Total
	Poor Awareness Frequency (%)	Good Awareness Frequency (%)	
A	7 (5.1)	129 (94.9)	136 (100)
B	10 (16.9)	49 (82.1)	59 (100)
C	4 (6.3)	60 (93.7)	64 (100)
D	6 (20.7)	23 (79.3)	29 (100)
Total	27 (9.4)	261 (90.6)	288 (100)

4.4 Compliance Level (Table 4-5): The level of compliance with general SRPs obtained on the Likert scale assessment (Table 4), recorded an overall compliance level of 83.3%, implying 16.3% of non-compliance with general SRPs. The level of compliance with 9 IOGP LSRs was obtained to be 91.5% (Table 5). The Participants had highest compliance with Confined Space Entry precautions (100%), followed by the rules and procedures on Bypass Safety Controls/Equipment (97.6%), Energy Isolation recorded 95.9%, Work at Height rules had 94.6%, Hot Work Safety precautions was 93.8% compliance, Safe Mechanical Lifting Safety Procedures had 91.0% compliance level, Safe Driving Rules had 87.4% compliance level, Line of Fire rule had 85.4% compliance, while Valid Work Permit rules had 82.3% compliance level and the least complied IOGP LSR (Figure 3).

Table 4: Summary of Compliance with SRPs Using the Means from Likert Scale

Companies	Level of Compliance with General SRPs		Total
	Mean score < 2.5 Frequency (%)	Mean Score >2.5 Frequency (%)	
A	17 (12.5)	119 (87.5)	136 (100)
B	13 (22.0)	46 (78.0)	59 (100)
C	10 (15.6)	54 (84.4)	64 (100)
D	8 (27.6)	21 (72.4)	29 (100)
Total	48 (16.7)	240 (83.3)	288 (100)

Table 5: Level of workers Compliance with the 9 IOGP LSRs

Variables	A (%)	B (%)	C (%)	D (%)	Total (%)
Bypass Safety Controls/Equipment (n = 288)	132 (97.1)	58 (98.3)	62 (96.9)	29 (100)	281 (97.6)
Confined Space Entry Work (n =136)	57 (100)	28 (100)	31 (100)	20 (100)	136 (100)
Safe Driving Rules (n = 223)	90 (89.1)	46 (90.2)	40 (76.9)	19 (100)	195 (87.4)
Energy Isolation (n = 246)	116 (95.1)	47 (95.9)	51 (98.1)	22 (95.7)	236 (95.9)
Hot Work Safety Precautions (n = 88)	133 (97.8)	51 (86.4)	59 (92.2)	27 (93.1)	270 (93.8)
Line of Fire (n=288)	127 (93.4)	43 (72.9)	49 (76.6)	27 (93.1)	246 (85.4)
Safe Mechanical Lifting Procedures (n=288)	129 (94.9)	47 (79.7)	60 (93.8)	26 (89.7)	262 (91.0)
Valid Work Permit (n=288)	122 (89.7)	39 (66.1)	52 (81.3)	24 (82.8)	237 (82.3)
Working at Height (n=239)	122 (98.4)	43 (93.5)	40 (90.9)	21 (84.0)	226 (94.6)
Total (n = 2284)	1028 (95.1)	402 (87.0)	444 (89.6)	215 (93.2)	2089 (91.5)

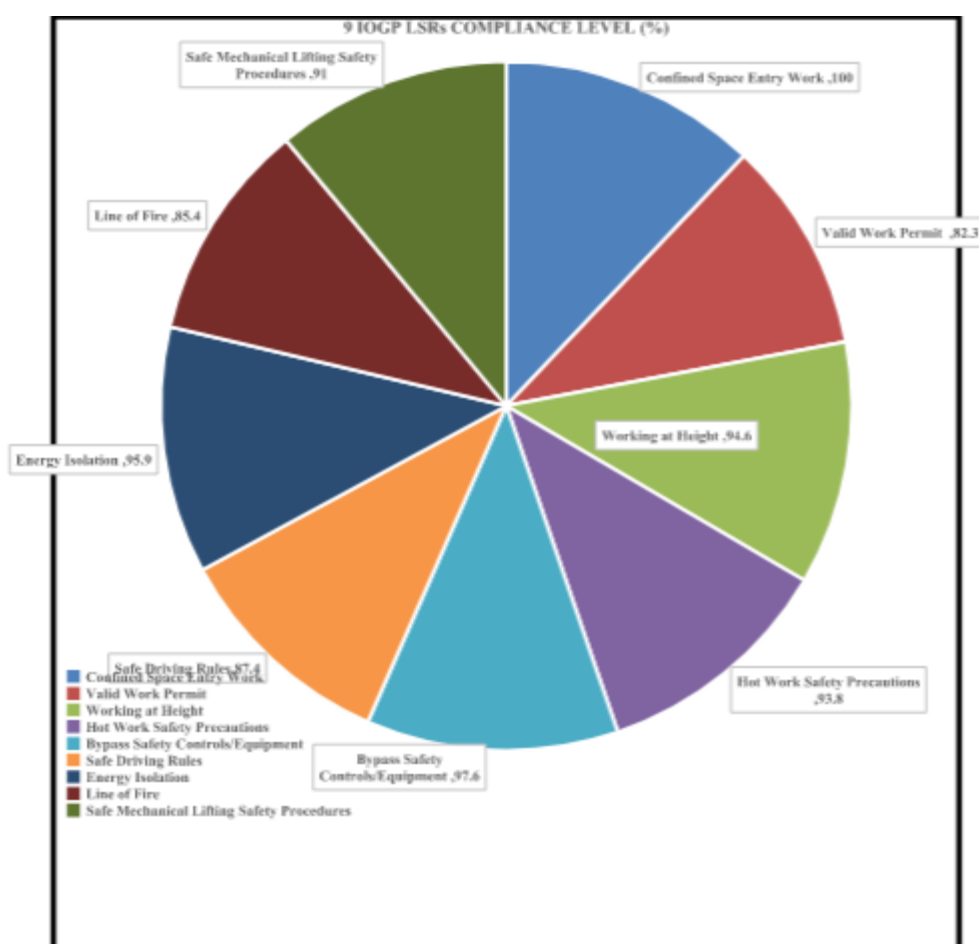


Fig. 3: Compliance Level of the Revised 9 IOGP Life-Saving Rules

4.5 Non-Compliances Registered and Reasons (Tables 6&7): The leaders responded to possible causes of workers failure to comply with LSRs and SRPs as influence of co-worker (peer pressure), poor attitude to work, poor safety leadership and ineffective management. Other reasons stated that could drive non-compliance were error enforcing conditions, poor management commitment to safety, ignorance of the consequences of non-compliance and poor/non-availability of tools and personal protective equipment when required. The study identified non-compliance with some SRPs & LSRs such as breaching safe driving rules, work authorization, by-passing safety critical controls, energy isolation rules, work at height rules, line of fire rules and hot work precaution rules. According to the workers and leaders who participated in the study, the most commonly

violated LSRs are the safe driving rules and work authorization rules (permit to work, PTW). These LSRs were non-compliances were recorded provides insights on the areas that need improvement and precursor to where energy should be directed to enhance safety compliance and avert incidents. From Table 7, it was vivid that the line of fire rule had the greatest number of workers non-compliances, followed by worker authorization rules (valid permit to work) and safe driving rules.

Table 6: Non-compliances with SRPs and Drivers by Leaders

Mostly violated Safety Rules and Procedures	Frequency (n=20)	Percentages (%)
Driving above speed limits/driving rules	19	95.0
Non-compliance to use of PPEs/Ineffective use of PPEs	13	65.0
Working without valid PTW	10	50.0
Housekeeping Issues	7	35.0
Poor waste segregation and disposal	5	25.0
Antecedents that drive Non-Compliance with SRPs		
Peer pressure/work overload/over confidence	11	55.0
Poor attitudes/bad behaviour/ignorance/complacency	9	45.0
Non availability or provision of PPEs or poor quality /right tools	9	45.0
Poor safety leadership	8	40.0
Poor /ineffective management	7	35.0
Ignorance of the effect of consequences/negligence/incompetence	6	30.0
Perceived poor commitment or support from management to resolve identified issues/under performance	5	25.0
Difficult design errors / error enforcing conditions	5	25.0

Table 7: Causes of Non-compliance with SRPs by Workers

LSRs Violated	Reasons for Non-Compliance
Bypassing Safety Critical Controls. (n = 7)	<ul style="list-style-type: none"> • Delay in approval (5) • Emergency situations (3) • Work pressure/demand (6) • Fear of underperformance (2)
Safe Driving Rules (n = 28) <ul style="list-style-type: none"> • Exceeding speed limit • Use of phones while driving • Use of drug/alcohol while driving 	<ul style="list-style-type: none"> • In a hurry (10) • No intervention received (2) • Inattention (3); • Fatigue (8) • Emergency (2)
Energy Isolation Rules (n = 10)	<ul style="list-style-type: none"> • In a hurry to start/finish task (4) • No intervention received (2); Assumption (1); • Trust on the isolator (1); Work pressure (6)
Hot Work Rules (n = 18)	<ul style="list-style-type: none"> • Emergency (3); Work demand/pressure (9) • Peer pressure/coworker influence (8) • Lack of awareness (4)
Line of Fire Rules (n = 42)	<ul style="list-style-type: none"> • Peer pressure/coworker influence (10) • Lack of awareness (5); Fear of no jobs (5) • Lack of materials needed (15); Inattention (7)
Work Authorization - PTW Rules (n = 51)	<ul style="list-style-type: none"> • Zeal to complete task (20) • Securing the environment in difficult situations (5) • Long PTW process / delays (18) • No one to apply and approve (20) • Dilemma to stop work or not (30)

Working at Height (n = 13)	<ul style="list-style-type: none"> • Lack of materials needed (8); In a hurry (5) • Work/time pressure (7) • Dilemma to or not to work /fear of unemployment (10)
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4.6 Discussion of Findings

This study discovered that there are promulgated SRPs (commonly known as 12 Life-Saving Rules) that align with 8 out of the 9 recommended IOGP LSRs. The IOGP LSR on the rule of “Line of Fire” was not included in the existing 12 LSRs disseminated in the workplace. Although, there are credible and demonstrable evidence of cascades and knowledge sharing materials on this rule at all levels in the various companies. It was confirmed that there are safety rules and procedures in place, which is in line with provisions of ISO 45001 (2018), MOSR (1997), Factories Act (1987). The study population is dominated by male (95.8%) against females (4.2%). This is in line with the male & female participants in Azuike et al. (2017), Adebola (2014) and Aliyu & Saidu (2011) of similar studies.

A higher proportion of participants 189 (65.6%) had acquired tertiary education while 99 (34.4%) attained secondary education. This finding corroborates with Adebola (2014) with 95% of participants having post-secondary education and Aliyu & Saidu (2011) where 78% of workers had tertiary education and in contrast with Azuike et al. (2016) where 94% of 318 participants in an automobile industry had only secondary education, also, with Liang et al. (2018) where only 1.4% of 345 railway workers had a degree and the other 98.6% had primary to secondary/technical college education.

The result shows that participants have high (90.6%) awareness level of SRPs. This corroborates with Adebola (2014), Eyayo (2014) and Aliyu & Saidu (2011) findings on workers awareness of occupational hazards in Nigerian petroleum downstream sector. This also, aligns with Awodele et al. (2014) amongst paint factory workers in Lagos, Nigeria. In contrast, workers in Italian agricultural sector had a low awareness level and negative approach towards safety at work (Cecchini et al., 2017). This can explain the reason for poor compliance in that study. High level of awareness of SRPs is critical for safety compliance and this can be acquired via formal and informal training (Kvalheim & Dahl, 2016; Pilbeam et al., 2016; Weichbrodt, 2015). The level of compliance with general safety rules and with the revised 9 IOGP life-saving rules (LSRs) was obtained as 83.3% and 91.5% respectively. This level of workers compliance from the evaluation study can be attributed to their high awareness level (90.6%) on general safety rules and procedures in the workplace. This corroborates with Aliyu & Saidu (2011) 78% and 85.9% of Adebola (2014) studies in the downstream sector. The findings from this study supports the conclusions of Olatubi and Olatubi (2017) and Weichbrodt (2015) which stated that compliance with SRPs ensures a safe workplace and results in higher productivity Windapo and Oladapo, (2012). Umeokafor et al. (2014) argued that compliance should not be <100% in order to achieve incident free workplace. Perhaps, incidents still happen in the workplace due to <100% compliance with SRPs and LSRs. The study identified most violated LSRs as safe driving rules, work authorization and hot work precaution rules, which also, affirms the findings of IOGP (2018B) on the most violated LSRs in her 459 report.

The reasons for non-compliance with SRPs as elicited from participants were error enforcing conditions, work pressure, conflicting goals, non-readily provision of tools and personal protective equipment, poor safety culture, limited compliance monitoring inter alia. These are management commitment failure and are in line with the findings of Jones et al. (2018), Wang et al. (2017), Weichbrodt (2015), Umeokafor et al. (2014) and Hale & Borys (2013). Other non-compliances recorded by participants were accredited to delays in securing approval for overriding safety critical equipment, having a valid work permit, emergency conditions, work pressure, lack of empathy interventions, poor fatigue risk management, zeal to complete task ahead of time, fear of under-performance and severance, cases of dilemma inter alia. These reasons fall into three specifics which are organisational, personal and work (Hale & Borys, 2013; Hale, Borys & Else, 2012). Reasons presented by the workers and their leaders for non-compliance with SRPs are in corroboration without significant variation. This affirms that it is a true reflection of the reality as per compliance and non-compliance with SRPs.

The study proposes a model shown in figure 4 and is presented as a management system tool to be used to address issues on non-compliance with SRPs and LSRs through investigations and implementation of findings and actions. In the model, the compliance loop also, directs a steer for continuous improvement (CI). To ensure effectiveness of any working system, plans and processes for CI are key requirements and CI is an element in the global standard of safety management such as ISO 45001 (2018).

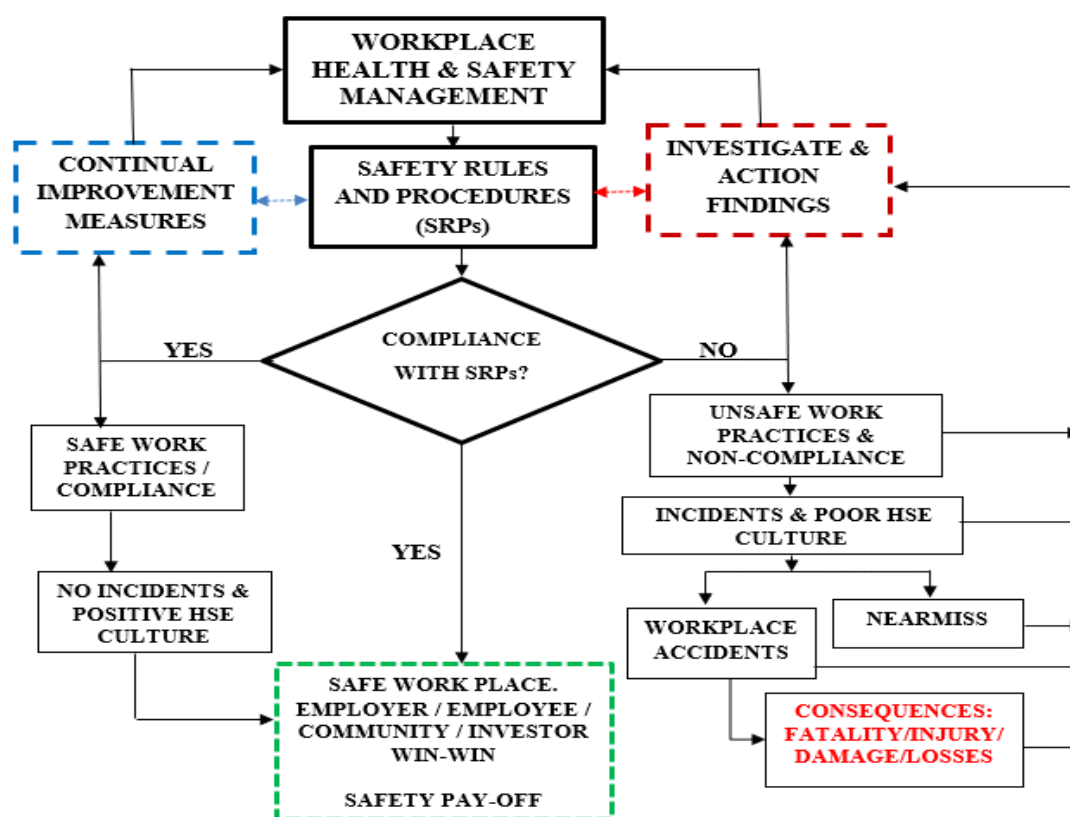


Fig. 4 Model for Management of SRPs in the Workplace

V. CONCLUSION

The participants awareness level of SRPs was high (90.6%) and high compliance level of 83.3% & 91.5% with general SRPs and 9 IOGP LSRs respectively. Out of the 9 IOGP LSRs, the rule on the line of fine, valid work permit and safe driving were the least complied with. This is a tell-tale and pointer to gaps that need attention before they lead to major industry accident. There are areas for improvement from findings and this behooves the management of O&G and allied industries to leverage on latent failures identified to improve on commitment to safety. SRPs and LSRs are designed to ensure incident free workplace. When workers are aware of these rules, comply with them, we have a safe workplace, payoff to the employer, employees and all stakeholders. Organisational, job and personal issues driving non-compliance are solvable by safety programmes that enhance workers' mental wellbeing and building of positive safety culture in the workplace. While we deploy infrastructure to improve on production and profitability, measures that ensure compliance with rules to preserve the human capital and asset should be integrated, for decent work, sustainable economic growth and development.

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