

# Occupational Health and Safety Hazards in selected Depots in Niger Delta, Nigeria

Grace Eyo Attih, John Ugbebor, Ejikeme Ugwoha

**Abstract**—The study evaluated the health hazards prevalent among workers in selected tank farms in Niger Delta, Nigeria by adopting a cross-sectional design where data were collected from 182 tank/depot workers purposively using questionnaire. A total of 200 copies of a closed ended questionnaire were administered to all cadres of staff which comprised of senior staff, middle and junior staff. Data were coded and analyzed at 95% confidence level. Most respondents agreed that some machines/equipment in their various workplace are not always in good condition which was further supported by the weighted mean result, with scores more than the criterion mean and grand mean of 3.00 and 4.10 respectively for each company. Most respondents disagreed that flammable substances like; PMS, AGO, HHK, solvent and other explosive-chemicals are not appropriately stored or handled in their workplace. This was further supported by the weighted mean result which scores were below the criterion mean and grand mean of 3.00 and 2.23 respectively, for each company. This study therefore recommends that government and supervising institutions should enforce compliance to OHS in industries, especially oil and gas companies so as to minimize hazards and risk levels.

**Index Terms**—Depots, Hazards, Niger-Delta, Occupational health and safety.

## I. INTRODUCTION

An oil depot, often characterized as a tank farm, is a manufacturing structure that stores oil and/or

petroleum products and transports them to end customers or other storage facilities.

An oil depot usually has above-ground or buried tankage alongside gantries for emptying products onto road tankers or pipelines. Hazards and health endeavours lurk at every business stage, including production projects, facility operations, maintenance, building, transportation, storage, and application of oil-derived goods. Any mishap issue in the industry will be worsened if equipment/materials are mishandled or misused.

Although much has been written about the dangers of the oil and gas sectors, risk cannot be totally eliminated with regards to the long-term effects on property, the environment and man. Dangers in workplace continue to be a major source of worry across all occupational health indices, including

human suffering and related economics. The global impact of industrial accidents, diseases, and disaster is frightening and thus requires urgent action (Ezejiakor, 2014). Following most of the operational conditions in the oil and gas sector are hazardous, safety and health management is hence a critical component.

Occupational hazards and dangers may lead to severe injuries, permanent incapacitation or morbidity and even death. It may further result to lower production, heavy equipment damage, material loss, and environmental deterioration. On this basis, it is vital to scrutinize the occupational dangers, risks, and facility integrity of oil and gas tank farms and depots in the Niger-Delta region of Nigeria. For decades, Nigeria's economy has exclusively relied on crude, primarily sourced from the Niger-Delta region. Hence, employee's health in oil industry is critical to their firms' productivity and nation's economy. Despite the fact that techniques to regulate, mitigate, or possibly prevent occupational hazards and health risks have been implemented over time, these hazards continue to occur on a regular basis, causing human suffering and financial hardship.

Working in the oil & gas industry exposes individuals to potential risks/hazards which are categorized into occupational, environmental and public health (Nnadi *et al.*, 2017). Hazard is defined as a condition that possess the potential to cause loss or harm (Johnson, 2000). Bello & Mijinyawa (2010) defined work related hazards as the risk to the health of a person usually arising from employment. According to Kalejaiye (2013), work-related hazards results from unsafe work-conditions and unsafe work-behaviors. Industrial hazards refer to any condition produced through industrial activities that poses harm or danger to workers, property, equipment or loss of productivity. That is industrial hazard is with the potential to cause injury or prove fatal to personnel or loss of property and products. Corrosive toxic substances, fire explosions and personnel falling into accident are major safety hazards encountered in the operations of process companies such as refineries, petrochemicals companies, bottling companies and breweries.

Workers in almost all companies are exposed to different forms of hazards on daily basis. Some industrial workplace hazards include; physical hazards, chemical hazards, biological hazards, ergonomics hazards and psychosocial hazards (Awodele *et al.*, 2014; Eyayo, 2014; Okon & Osesie, 2017).

This study looks into work hazards in oil and gas facilities. Many of these hazards are domicile in the recent state of facilities and activities in Nigeria's petroleum and oil refining and distribution business. The high toxicological qualities of oil/gas components, exploration, extraction and processing makes the process quite complicated and poses health risks to

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personals involved. The operations involved includes; distillation, reformation, catalytic cracking, and power generation, all of which place employees' risk and expose them to workplace dangers.

## II. RESEARCH METHODOLOGY

### A. Research Design

This study utilized a combination of field measurements and analytical cross-sectional research design. This design is relevant as it involved collecting data from respondents and presenting them without manipulation. Consequently, both quantitative and qualitative methods were employed to assess and investigate the risks prevalent in the process industry. In the descriptive-quantitative method, the participants in this study were selected based on their, awareness, characteristics and knowledge of safety, hazards and risks associated in process industry.

### B. Study Area

The Niger Delta region is situated in the Gulf of Guinea between longitude 5°E to 8°E and latitudes 4°N to 6°N (Opafunso, 2007). ERML (1997) defines the original Niger Delta region (about 29,900 square kilometres) as comprising the area covered by the natural delta of the River Niger and the areas to the east and west, which also produce oil. Its approximate northern boundaries are located close to the bifurcation of the River Niger at Agboh, while the western and eastern boundaries are around the Benin River and the Imo River respectively. It is the largest wetland in Africa and the third largest in the world consisting of flat low-lying swampy terrain that is crisscrossed by meandering and anastomosing streams, rivers and creeks. The Niger Delta region of Nigeria comprises the nine states; Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Imo, Ondo and River States, with an approximate population of 21,014,655 according to the national population census of 2006 (Agbor & Ashabua, 2018). This well-endowed ecosystem, which contains high concentrations of biodiversity on the planet, in addition to supporting the abundant flora and fauna, arable terrain that can sustain a wide variety of crops and economic trees, has more species of freshwater fish than any ecosystem in West Africa. Nigeria oil & gas reserves are situated in the region, contributing to 90% of government revenue.

### C. Participants of the Study

The population in this study revolves around oil and gas facilities in the Niger Delta Region and includes all the individuals whose daily work activities exposes them to hazards and risks. It comprises of a group of facility workers of depots and tank farms in the Niger Delta, Nigeria. Male and female between the age range of twenty-one (21) years to sixty (60) years in the oil and gas facilities (Public and Private Depots) whose duties and day to day business are such that they are exposed to hazards and risk in their work place or environment. These individuals comprise staff and contract staff gainfully employed loaders, safety officers, health personnel, production staff, maintenance staff, lab

scientist, site surveyors, all managers and supervisor of all cadres.

### D. Sample and Sampling Techniques

The study adopted a non-probability purposive-sampling technique. Representative samples were collected via sound judgment from the study population (Black, 2010). Oil facility workers that have been duly employed as staff/locum that can provide dependable information were purposely selected for the study. The determined sample size was obtained by utilizing Taro Yamane's formula (1967). Probabilistic stratified sampling was adopted for selecting respondents, as the target population has two groups and cut across all staff. Two separate strata were divided (technical and management staff), and for each stratum or group, those in the departments exposed to hazards and risk were selected. For each stratum, members (such as technical staff) were given a number.

### E. Data Collection and Quality Control

The data used was gathered from multiple sources; primary and secondary sources. All the data were reviewed and organized into category that cut-across all the data sources. Primary data was obtained with the aid of self-administered questionnaire and checklist auditing based on the research questions of the study. The data was gathered from all the departments, and from both contract and permanent staff who gave consent to answer the questionnaire.

Personal interviews were engaged in with some workers, which will enhance the worth of information that were derived from the questionnaire concerning occupational hazards and health risks. Before undertaking the data collection process, an official letter was addressed to respective managements in the various studied facility seeking the participant's consent. Each management of the designated depots and tank farms were assured of treating the information from respondents/participant confidentially. Hence, the data collection procedure of the study followed due process and study was done via; walk through survey, structured questionnaire, and review of documents, reports, secondary data, observations and an inspection checklist. The questionnaire was structured and properly evaluated using five-point Likert-Scale format namely; Strongly-Disagree (SD), Disagree (D), Agree (A), Strongly-Agree (SA) and undecided (U).

A total of two hundred (200) copies of questionnaires were distributed to the six selected tank farms. Forty each to tank farm A and D, while 30 each were distributed to tank farm B, C, E and F, out of which 182 were fully filled, completed and returned representing 91%. Thus, the number of response rate was sufficient, which provided enough proportion for data analysis and its interpretation. Generally, 91% of respondents participated in the survey exercise and provided necessary information which formed the basis for data acquisition.

## F. Data Analysis

Collected data from copies of questionnaire were processed, coded and analyzed utilizing XLSTAT 2018 premium version software, developed by Addinsoft (2018). The percentage, mean and standard-deviation of respondents were determined.

## III. RESULTS

### A. Questionnaire Administration and Retrieval

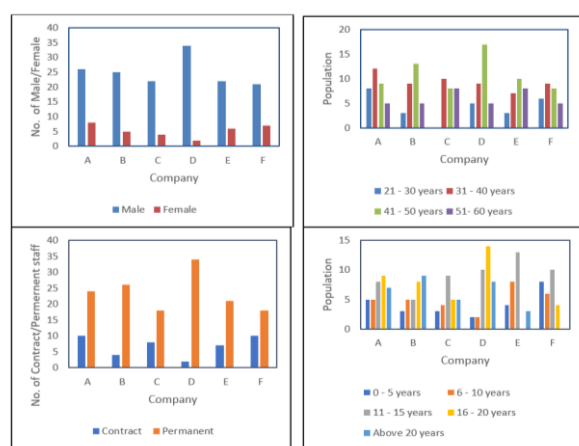
A total of 20 questionnaire were administered to the six companies as indicated in Table 4.1. One hundred and eighty-two (182) were correctly filled and returned. Companies A and D were government owned while other four (4) were privately owned.

**Table 1:** Questionnaire distributions and respondent's participation

Respondent	Number completed and returned	Percentage completed and returned
Depot A	34	18.6
Depot B	30	16.5
Depot C	26	14.3
Depot D	36	19.8
Depot E	28	15.4
Depot F	28	15.4
Total	182	100.0

### B. Demographic Distribution of Participants

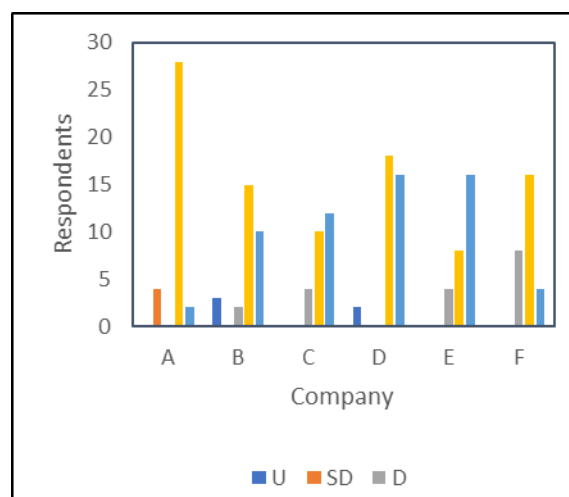
Figure 1 shows the demographic distribution of participants. The socio demographic profile of the respondents considered were employment status, gender, age, educational qualification and marital status. Most respondents (35.7%) were between 41-50 years, very few (13.7%) were between 21-30 years. Of the 182 respondents, 82.4% were male, while 17.6% were female. 77.5% were permanent staff while the remaining (22.5%) were contract staff. About 13.7%, 29.7% and 22.0% of the respondents had 0 – 5 years, 11 – 15 years and 16 – 20 years working experience respectively. This means that 65.4% of the respondents had 0 – 20 years of work experience, making them the majority. However, when combined, 37.6% had over 15 years work experience.



**Figure 1:** Demographic Distribution of Respondents

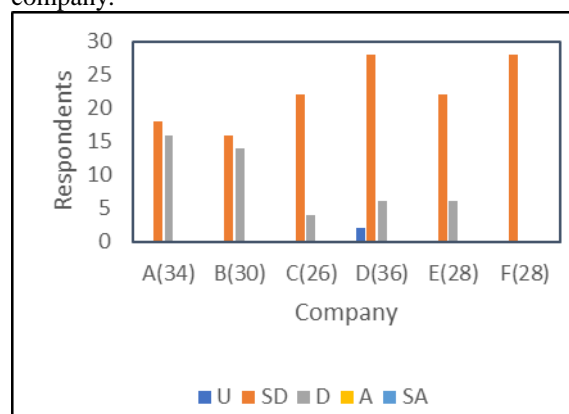
### C. Occupational Health and Safety Hazards

Figure 2 presents respondents opinion on the working conditions of machines/equipment in their various workplace. In company A, 82.0% of the respondents stipulated (agreed) that their machines/equipment are not always in good condition, 5.9% strongly agreed, while 11.8% strongly disagreed. A weighted mean of 3.82 indicate a general agreement to the statement. In summary, most respondents agreed that some machines/equipment in their various workplace are not always in good condition. This was further supported by the weighted mean result, which scores were more than the criterion mean and grand mean of 3.00 and 4.10 respectively for each company.



**Figure 2:** Working conditions of machines and equipment

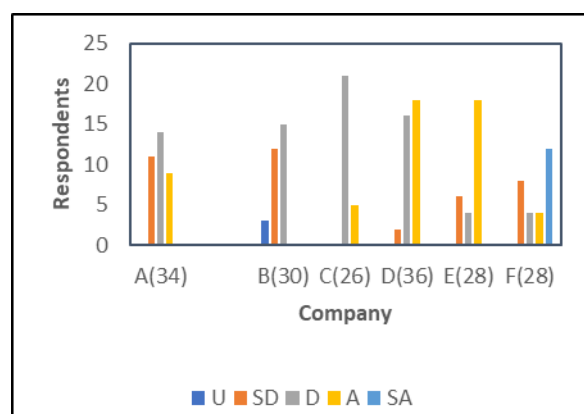
Figure 3 presents respondents opinion on the storage and handling of petroleum product like; PMS (premium motor spirit), AGO, House hold kerosene, and other flammable substances in their various workplace. In company A, all the respondents (100%) disagreed that flammable substances like; PMS, AGO, HHK, solvent and other explosive-chemicals are not appropriately stored or handled, while none (0%) agreed nor strongly agreed. A weighted mean of 2.47 indicate a general disagreement to the statement. In summary, most respondents disagreed that flammable substances like; PMS, AGO, HHK, solvent and other explosive-chemicals are not appropriately stored or handled in their workplace. This was further supported by the weighted mean result which scores were below the criterion mean and grand mean of 3.00 and 2.23 respectively, for each company.



**Figure 3:** Poor storage and poor handling of petroleum products in the tank farm/depot.

Figure 4 presents respondents' opinion on the presence of loose electric cables, wires and uncovered sockets in their workplace. In company A, most respondents (73.5.0%) disagreed to the statement that; there are loose electric cables, wires and uncovered sockets; 26.5% strong disagreement, while 45.0% agreed. However, a weighted mean of 2.94 indicate a general disagreement to the statement.

In summary, most respondents in company A and B disagreed to the statement that; there are loose electric cables, wires and uncovered sockets, while majority of the respondents in other companies agreed to the statement. These was further supported by the weighted mean result as the scores for companies A and B which were below the criterion mean of 3, while each company weighted mean is above 3. In general, the grand mean of 3.23 indicates that the respondents agreed to the statement.



**Figure 4:** Loose electric cable, wires and uncovered sockets in the facility

Table 2 illustrates the summarized weighted means and grand means of the statements for the identification of occupational hazards in the depot/tank farm. From the table, the weighted mean of all the companies were above the criterion mean of 3.00, which infers that the respondents in each company agree with the statement. A grand-mean of 3.67 further indicate a general agreement to the statement.

**Ho<sub>1</sub>:** There is no significant difference in the occupational hazard exposure among workers in oil & gas facilities

Table 3 depicts the different occupational hazards that workers in oil & gas facilities from the various companies. The table shows an F-score of 39.775, which is greater than (>) the critical value, 2.21 at 0.05 significance-level. This difference could not have happened by chance, with 0.000 significance level. Hence, the null hypothesis that; there are no significant variations in occupational hazards exposure among workers in oil and gas facilities, is rejected, whereas the alternative-hypothesis is accepted. This infer that the workers in selected oil and gas plants are exposed to different occupational hazards in the study area.

**Table 2:** Summary of means and grand means for Identification of Occupational Hazards in the depot/Tank Farm

Referents	Companies Weighted Mean						Grand Mean
	A	B	C	D	E	F	
1	2.45	2.92	4.54	4.78	4.85	4.86	4.00
2	2.84	3.00	2.46	4.44	3.23	3.29	3.26
3	2.95	4.00	4.92	4.56	4.08	4.43	4.09
4	3.10	4.00	4.54	4.72	4.69	4.50	4.20
5	2.50	3.25	4.62	4.22	4.23	4.14	3.76
6	3.80	4.00	4.46	4.39	4.50	4.00	4.17
7	2.90	3.50	4.62	4.44	4.23	4.43	3.97
8	4.11	4.33	4.31	4.28	4.15	4.36	4.25
9	3.16	3.00	3.20	4.41	3.23	2.64	3.32
10	3.70	3.25	4.08	4.44	4.46	4.21	4.03
11	4.10	4.42	4.38	4.33	4.42	3.07	4.11
12	2.65	2.83	4.46	4.33	4.25	2.71	3.51
13	2.65	2s.91	2.69	4.35	3.46	2.46	3.11
14	1.90	1.42	1.15	1.28	1.15	1.00	1.36
15	3.75	4.00	4.69	4.67	4.92	4.71	4.42
16	2.80	1.75	4.54	4.00	4.00	3.29	3.40
17	3.00	3.08	4.38	3.88	3.85	2.85	3.49
18	2.25	2.08	4.54	4.28	3.92	2.71	3.27
19	3.35	3.25	4.69	4.50	4.77	4.57	4.16
20	3.10	2.25	4.38	4.11	3.92	2.85	3.46
<b>Total</b>	<b>3.05</b>	<b>3.16</b>	<b>4.08</b>	<b>4.22</b>	<b>4.02</b>	<b>3.55</b>	<b>3.67</b>



**Table 3:** Identification of Occupational Hazards in the depot/Tank Farms

Hazard Identification	ANOVA				
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	20.283	5	4.057	39.775	.000
Within Groups	17.897	176	0.102		
Total	38.180	181			

#### IV. DISCUSSION

The result shows that almost all respondents agree that tank farms/depots are riddled with diverse safety/health concerns. Most machines are antiquated and perform below optimal, according to the respondents. These scenarios are hazardous to the facility's personnel and pose a significant danger. The finding is in line with Ogbuigwe (2018) study, who stated that machines and other service facilities are subject to deterioration due to their use and continuous exposure to process/environmental conditions.

Given the flammability and high flash point of liquids and goods such premium motor spirit, household kerosene, and AGO, every responder said it was properly stored and monitored. In summary, most respondents acknowledged that some of their workplace's machines/equipment are not always in good working-order. The weighted mean results, which showed that each company's scores exceeded the criterion, mean of 3 and had a grand mean of 4.17, backed up these claims. At conclusion, the majority of respondents disagree that flammable compounds such as PMS, AGO, HHK, solvent, and other explosive chemicals are improperly stored or handled in their workplace. The weighted mean results, which showed that each company's scores were less than the criterion mean of 3 and a grand mean of 1.36, backed up these claims. As discovered in this study, petroleum products are highly flammable and very hazardous, therefore must be properly stored as seen in this research. The study tallies-well with Hassinger & Watson (2021) study, who opined that liquid petroleum products like; gasoline, diesel and kerosene must be stored safely to prevent leaks and spills. This implies that petroleum tank farms pose a great hazard to the workers alongside the environment. This indicate poor state of most tank farms and conform to Uqwukah and Ohaja (2016) that the depots integrities have been compromised because of the constant replacement and repair of the segment, which is responsible for the non-attainment of effective pumping rate of liquids in order to prevent pipeline leakage and consequent environment pollution

In conclusion, most respondents in firms A and B disagreed that there are loose electric cables, wires, and unprotected sockets, but majority of respondents in other companies agreed. The weighted mean result corroborated this, as the firm A and B scores were below the criterion mean of 3, while the weighted mean for the other companies was over 3.0. The grand mean of 3.40 indicates respondents' agreement that there are loose electric cables, wires, and unprotected sockets.

#### V. CONCLUSION

In conclusion, majority of the depots have outlived their useful lives and most of the equipment is antiquated and in

bad functioning order. Workers at tank farms and depots face similar occupational hazards, from the report. Various depots store petroleum products with high flash points and their related carbon compounds, with relatively different level of harm to people, property and environment. This study therefore recommends that government and supervising institutions should enforce compliance to OHS in industries, especially oil & gas companies so as to minimize hazards and risk levels.

#### DECLARATION OF INTEREST

The author(s) declare no potential conflict of interest with respect to the research, authorship, and/or publication of this article.

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