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I. INTRODUCTION

Much focus is placed on waste management in Ghana, especially in the urban sectors than the rural sectors. These wastes are sent to a few dumpsites, but, the majority are dumped in drains, streams, and open places. Waste is disposed of by open dumping, open burning, controlled burning and tipping at dumpsites. This has caused a pressing sanitation issue as many towns and cities are overwhelmed with the management of solid and liquid wastes". this explains the current situation in Ghana and its effect on the economy.

Waste management has been and continues to be a greater problem due to the increasing activities that generate larger volumes of both hazardous and non-hazardous waste. Although the Ghanaian government and other international agencies continue to make conscious efforts to regulate and manage the activities, it has come to a halt since there is not enough sophisticated technology to effectively manage waste generated in offshore and onshore activities in the oil and gas industries.

This phenomenon has rather caused rapid waste management concerns. The oil and gas industries contribute substantially to the growth of every economy. Over the last two decades, waste management practices in Ghana have been an issue that has faced tremendous attention. Waste management is one of the most critical components of oil and gas exploration and production activities and a major concern (Derefaka, 2014; Chen and Lin, 2008; Raj, Prasad, and Bansal, 2006). The conditions of re-use, reduction, recycling, and recovery of waste and non-renewable resources have increased in the last decades, which has prompted governments and agencies to develop policies that could help protect the environment.

The attitudes of multinational companies and individuals' responsibility towards waste management have received several considerations in various jurisdictions including water, hygiene, The attitudes of multinational companies and individuals' responsibility toward waste

management have received several considerations in various jurisdictions including water, hygiene, and sanitation (Manaf, Samah, and Zukki, 2009; Metin and Neyim, 2003; Abdulla, Qdais and Rabi, 2008). Consequently, Derefaka (2014) asserts that the merit of good waste management includes critically managing waste in a way that will not have any negative impact on human health and the environment. Waste generation is part of human and industrial activities and cannot be eliminated. Consequently, the increase in population and advancement in technology has caused the environment to be more contaminated (Lee and Min, 2014).

Management of waste has become a major challenge facing developed countries all over the world which are trying to implement standards to reduce their environmental impacts. It is important to manage waste materials which help create a clean, healthy, and safe environment (Kainth, 2009). Focusing on proper waste management practices will not only get rid of their negative impact but also implement standards and procedures of countries that are well-informed and have had and sanitation (Manaf, Samah, and Zukki, 2009; Metin and Neyim, 2003; Abdulla, Qdais and Rabi, 2008). Consequently, Derefaka (2014) asserts that the merit of good waste management includes critically managing waste in a way that will not have any negative impact on human health and the environment. Waste generation is part of human and industrial activities and cannot be eliminated. Consequently, the increase in population and advancement in technology has caused the environment to be more contaminated (Lee and Min, 2014).

Management of waste has become a major challenge facing developed countries all over the world which are trying to implement standards to reduce their environmental impacts. It is important to manage waste materials which help create a clean, healthy, and safe environment (Kainth, 2009). Focusing on proper waste management practices will not only eliminate their negative impact but also implement standards and procedures of countries that are well-informed and have a good track record of managing waste (Gabrscek and Isljamovk, 2011). Some developing countries are exploring different and other advanced technologies such as advanced recoveries and recycling of waste (Defra, 2011; Manaf et al., 2009; Metin and Neyim, 2003; Abdulla, Qdais, and Rabi, 2008).

According to Ciocoiu et al., (2016), every country has its ways of managing waste. In advanced countries, several companies have begun to integrate the environment into their work strategies to achieve their environmental and business performance simultaneously. These companies, in turn, increase their profitability, productivity, and performance by cutting down on waste and emissions (Florida and Davison, 2001). Similarly, Zaman and Lehmann (2011) assert that many developed countries are putting in place measures for zero-waste management practices.

The effects of improper management of waste in the oil and gas sector may include the emission of dangerous and poisonous gases into the atmosphere, pollution of water bodies as well as environmental impacts (Gonzalez, 2015). Waste management has been defined as the collection, transport, recovery, and disposal of waste, which includes the supervision of such disposal plans and the after-care of disposal sites, and including actions taken by a dealer who purchases and subsequently sells waste or a broker who acts on behalf of others in arranging recovery or disposal of waste (Gonzalez, 2015). On the other hand, Funmilayo (2014) defined waste management as the collection, transportation, and disposal of garbage sewage, and other waste products.

Even though some developed countries are finding new technologies to improve their waste management practice to a near or if possible zero-waste practice, implementing such waste management practices in a developing country like Ghana is somehow difficult. In developing countries, managing waste is somewhat perceived as solely the responsibility of the government. Meanwhile, budgetary allocation for such projects becomes minimal due to unprecedented corruption and another embezzlement of funds for the management of waste (Ray, Taylor, and Chapman, 2012). Waste generation accompanies

every oil and gas production activity both onshore and offshore. Creating awareness of the importance of the safe management of waste has become very crucial. The Conference Proceedings of UNCED in Rio in 1992 highlighted the challenges regarding sustainable development and environmental protection. These guidelines as prepared by the Oil Industry International Exploration and Production Forum (E&P Forum) and United Nations Environment Programme Industry and Environment Centre (UNEP IE). Waste management programs are now becoming a necessity in the generation and recycling of waste.

Schlumberger Oilfield Services offers an array of services from seismic, deep-water drilling, directional drilling, wellbore productivity tools, engineering services, drilling completion, and workover fluid chemicals, sales, and engineering services, and information technology services, training and after-sales training of advanced technology tools. It also operates in the design formulation and maintenance of complex wells and provides expert services in technical advisory and support throughout the drilling campaign. The corporate headquarters is in Houston, TX with over seventy-five thousand employees worldwide. The company has several departments such as Human resources, legal, operations, and technical support. It is a multinational company with over a hundred branches throughout the world (http://www.slb.com). The mission of Schlumberger Limited is to transfer knowledge, technical innovation, and teamwork**.** Customer focus is their main priority and therefore requires stronger technologies to help overcome the challenges of their customer.

Zoil Services Limited specializes in treating hazardous and non-hazardous waste products from oil and gas exploration activities as well as industrial waste. The company has been certified by the Ghana Environmental Protection Agency (EPA) as capable of treating and managing industrial waste. Zoil has been in operation since February 2009 for such a purpose. Zoil operates an ultra-modern Anaerobic Thermal Desorption Unit (ATDU), an industrial incinerator, and a wastewater treatment system to manage industrial wastes. Zoil can boast as the only treatment company in Ghana to own an ATDU which began usage in June 2014 and it is currently the only one of its kind operating in Ghana. Zoil's waste treatment facility is in Nyankrom, Shama District, near Takoradi, in the Western Region of Ghana.

The organizational structure of Zoil is made up of Health, Safety, and Environment (HSE), Maintenance, Electrical and Instrumentation, Operations, Process, Human Resources, and Finance departments. These can be attributed to the quality of service they provide for the good environmental impacts of industrial activities. Zoil's vision is to become one of the leading industrial waste management companies in the West African sub-region. They use sound engineering and modern treatment methods to treat hazardous wastes and effluent water streams to standards that fully meet or exceed international standards, (www.zoilservices .org). The operations of these two companies are mainly in the oil and gas sector. Therefore, they need to pay attention to issues such as the management of waste generated for the betterment of their operations and in the interest of the larger society within which they operate.

Empirical evidence supporting waste management practices appears to be overhauling (Defra, 2011; Manaf, et al., 2009; Metin and Neyim, 2003; Abdulla, Qdais, and Rabi, 2008). Studies conducted in various jurisdictions concerning waste management practices include Spain (Mena, Adenso-Diaz, and Yurt, 2011; Rodriguez, Alegre, and Martinez, 2007); the US (Clelland, Dean, and Douglas, 2000; Min and Galle, 2001); Nigeria (Kofoworola, 2007; Nnorom and Osibanjo, 2008); Australia (Zaman, 2014; Berkel, 2007). Various scholars have posited that there has been a tremendous improvement in the recycling and recovery of waste from the environment. However, the management of waste is a major challenge confronting countries putting in much effort to meet international requirements for waste management. According to Deng et al. (2016), every country has a unique approach to managing waste.

Operational activities associated with petroleum products in the oil and gas industry bring adverse impacts to the environment and may result in air pollution, contamination of water bodies, groundwater pollution, shortage of land for waste disposal, and potential financial liabilities. Latif and Iskandar (2019) concluded that due to improper waste management, the conditions worsen which consequently lowers the quality of life of the population. Although waste management is crucial in oil and gas exploration and production activities, it also brings hazards to the environment. (Gonzalez, 2015) asserted that although the treatment of waste is carried out at facilities that are well designed for this purpose, it does not fully protect the environment against the biproducts from these treatment activities. Most oil and gas companies use landfilling to manage waste disposal treatment. However, this waste treatment method has adverse impacts as it may contaminate the groundwater when the waste leaches into the soil. In a study conducted by Funmilayo (2014), it was found that the "sticky" nature of the waste enabled it to accumulate and threaten the environment if it is not managed appropriately and hence the rationale behind this study.

Waste management has become an issue not only in the oil and gas sector of Ghana but also in almost every area of the country. Particularly, there were problems highlighted in the Ghanaian oil and gas industry regarding the improper ways of managing waste. In other words, one notable issue that presents a challenge to the oil and gas industry is how to ensure proper waste management within the sector (Lodungi et al., 2016). It is generally believed that managing waste has been a problem in sectors including the oil and gas sector mainly due to a lack of skilled personnel, lack of proper education in handling waste from energy, and inadequate laws to protect the environment. Other concerns are the deficit in petroleum waste management technology in Ghana, the lack of facilities for managing waste, inadequate facilities, and the cost of petroleum waste treatment. Thus, there are concerns about the management of waste in the oil and gas sector which require further investigations. Against this background, this study sought to empirically contribute to the efforts in expanding knowledge concerning waste management practices in the oil and gas sector using Schlumberger Oilfield Services and Zoil Services Limited as a case to proffer suggestions for improvement.

The study examined the waste management practices in Schlumberger oilfields and Zoil service limited. In subsequent sections of this paper, the discussion will follow the theoretical and empirical discussions on waste management. This will be followed by the methodology of the study and the results and discussion of field data. The final section is dedicated to conclusions and policy implications.

II. THEORY AND EMPIRICS ON WASTE MANAGEMENT

The passage discusses various theories and concepts related to waste management, environmental economics, and sustainability. Waste management is critical to prevent harm to human health and the environment, and different waste management practices are linked to the type of waste generated and economic considerations. The Waste Management Theory (WMT) is based on the principles of Industrial Ecology aims to prevent harm to human health and the environment, while the environmental economics theory is based on cost-benefit principles and values ecosystems to ensure optimally economic growth while considering the contribution of environmental ecosystems. Sustainability theory assumes that environmental resources are finite and requires three basic competencies to manage resources effectively and efficiently without compromising future needs. The passage also highlights the importance of technological advancements and the role of companies in making cost-benefit decisions about their operations within the larger environmental setup to lessen the adverse impact of their operations on the environment.

Over the years, oil and gas industries review their methods of operations to enable them to cut down on the waste they generate through their activities. Design and re-engineering of storage

capacities for toxic and hazardous waste, improved facilities for technical training and education on treatment procedures as well as investment into skilled and qualified personnel to effectively manage these wastes. These in place have helped manage the waste they generate through their activities.

Waste Management Theory (WMT) has been espoused critically in environmental sciences through engineering design. WMT encapsulates a unified body of knowledge about the waste management system and practices in today's economy. In the oil and gas industry, because of technological advancement and diversification of innovation, conceptual models and other academic theories need to be consolidated for proper integration of waste management practices to be done. It was argued that WMT is developed based on the principles of Industrial Ecology (Derefaka, 2014). The Theory of Waste Management is premised on the fact that waste management should prevent causing harm to human health and the environment, which leads to the conservation of resources (Manaf, Samah, Zukki, 2009). However, industrial ecology successfully combines waste minimization with resource use optimization measures and ensures that resources are effectively circulated within ecosystems. This theory is crucial to this study because waste management aims at preventing causing harm to human health and the environment. Thus, the study will help in bringing out environmental issues into industries' processes and product design.

The environmental economics theory is based on cost-benefit principles. The theory states that there is a depletion of natural resources and ecosystems to achieve economic development (Pearce, 2002). The theory also draws its assumptions from the Pareto principle which suggests that if precise compensation is made to the 'loser' a complete ideal position can be achieved. The key tenet is that it is possible to attain optimal growth through an effective economic system that correctly considers the contribution of environmental ecosystems (Zhiqiang et al., 2001).

It is believed that environmental problems are the result of the failures of the economic system to enhance human well-being (Pearce, 2002). Thus, environmental economics aims to guarantee that ecosystems are valued as vital contributors to overall human well-being as well as economic growth objectives. Ensuring maximum advantages through the optimum use of natural resources is not effective because of the multi-functional contribution of ecosystems. To sustain the environmental economics approach, there is a need for technological advances and progress.

Environmental economics values ecosystems to rebalance the market failures that result in the effects of pollution. A monetary value is placed on ecosystem services mainly to internalize the results of pollution within a cost-benefit analysis (Zhiqiang et al., 2001). Valuation in monetary terms also becomes useful for comparing ecosystem benefits with other economic costs and benefits within the process of environmental impact assessment (Pearce, 2002).

Environmental economists do not share the view of dependability amongst various forms of capital. The theorists view the possibility that natural capital can be substituted and further point to the development of better extraction methods and the finding of other resources which in turn extend the life span of specific finite resources. They also stress the role of technology and human advancement in the efficient use of natural resources (Zhiqiang et al., 2001). Companies including those in the oil and gas sector make cost-benefit decisions about their operations within the larger environmental setup. Their activities largely tend to deplete the environment as a result of the heavy equipment, chemicals, and other harmful substances they use in the course of their operations. They generate so much waste in the course of their activities. Given the importance of their activities to human life, it is logical that measures are put in place to lessen the adverse impact of their operations on the environment. Particularly, since the sustainability of the environment is critical to human life there's a need for these companies to pay attention to the management of the waste they generate. Thus,

this theory is relevant to this study because managing waste is critical in sustaining lives.

The sustainability theory was popularized by World Commission on Environment Development in the 1970s. The theory was founded on the environmental limit theory by economists such as Thomas Malthus and David Ricardo It assumes that environmental resources are finite and hence the economy must have restrictions. Efforts must be made to use resources effectively and efficiently without compromising on the resources and needs of the future generation (Briassoulis, 2001; Brundtland, 1987). The management of these resources requires three basic key competencies. These are competencies competence, technical competence, and context and dual competence (Beata et al., 2014).

The sustainability theory also talks about equal treatment for both humans and social and natural resources. This is because these resources are very crucial to both human and organizational development (Briassoulis, 2001; Commission of the European Communities [CEC], 2013). The efficient and effective use of social, human, and natural resources provides long-term developmental outputs at both national and organizational levels. The theory is vital to this study because companies including oil and gas companies need to institute measures to sustain the environment for the greater good of themselves and the world, at large. One notable way to achieve this is to properly come out with mechanisms to manage the various kinds of waste they generate in the course of their operations. The waste generated will eventually destroy the environment if no measures exist to effectively manage them.

In Ghana, there have been instances where there have been various degrees of spills and outbreaks have occurred due to weak observance of waste management protocols. This has resulted in the loss of lives and properties (Raj. Prasad and Bansal, 2006; Hossain, Santhanam, and Norulaini, 2011). This outcome has forced various legislations to enact laws and directives to control and further reduce incidents. Good waste management techniques will help mitigate bad outcomes from improper waste management activities. Waste generated from other countries cannot be further broken down into other useful substances due to their dangerous nature and must therefore be used only for landfilling and incineration (Chen and Lin, 2008). In certain countries like the Niger Delta, several treatment facilities available are obsolete because most of their equipment has been used for several years which has caused them to deteriorate because it has exceeded the life span. (Ibem-Ezera, 2010). This is because pipes that have operated above the installed capacity should therefore not be in use as it may lead to ruptures and explosions, and so waste will be created.

According to Zhao (2017), one of the factors leading to improper policy enforcement in waste management in the Ghanaian economy is due to inadequate facilities and funds to handle its treatment. The oil and gas industry in Takoradi suffers from the unavailability of waste treatment facility constitutes a serious dilemma in the management of waste streams (Derefaka, 2014). It has been noticed that Ghanaian waste management adopted the use of host community contractors to enhance local content, but there are issues the compliance with standards. Facilities that can accommodate waste for further innovation are underestimated in the Secondi/Takoradi constituency.

According to the United States Environmental Protection Agency (2002) website, environmental education (EE) has been defined as the means of making individuals understand and have an awareness of the need to protect their environment and further make recommendations on ways to conserve it. Effective implementation of such education will further help raise awareness among the residents of the country about how important it is to conserve the environment. It will trigger them to take action and be more responsible toward the environment. EE is crucial for the management of waste disposal, especially in the oil and gas industry which contributes to major pollution to the world at large and thus lowers the quality of life. Mwiinga (2014) revealed that controlling activities that result in a high generation of waste

will further help reduce waste accumulation. These phenomena could be achieved through EE. Creating environmental awareness of accidental discharge on our water bodies as well as the environment is important from a global perspective of resource management (Agunwamba, 1998). In Zambia, a study by Sichaaza (2009) found that waste was found all over public places due to a lack of knowledge and negative attitudes towards waste management. They possessed negative attitudes because they lack education on the subject matter (Mwiinga, 2014). Notwithstanding the countries, Ghana on the other hand has requisite technologies that can turn waste into valuable assets. However, experts who can help manage waste are inadequate in Ghanaian society.

Lodungi (2014) found that managing the waste produced must follow guidelines such as Petroleum Development Act 1974, Petroleum Regulation 1974, Gas Supply Act 1993, and Environmental Quality Act 1974. Also, Ugochukwu (2008) and UNDP (2006) observed that factors contributing to issues of environmental concerns in Nigeria are the lack of strict measures by law enforcement agencies. Inability to demarcate substantial lands for industrial use from domestic use. This enables industries that generate high levels of waste to pollute communities that are cited closely to these sites and hence are exposed to these detrimental conditions. Where there is an absolute absence of laws, waste production in the oil and gas industry may be on the rise. Failure on the part of the Government brings about weak systems which leads to failure to implement good policies. (Ibem-Ezera, 2010).

Developing countries like Ghana have weak financial muscles like the Philippines, Malaysia, Thailand, and Sri Lanka, which equally lack the capital to procure expensive technologies for solid waste management (Zhao, 2017). Scholars have further stated that technologies successfully used in developed countries may only result in a greater debt in developing countries instead of a solution. The Philippines for instance is a low-middle-income developing country. A lack of capital can be a barrier to applying waste-to-energy (WtE) technologies (Zhao, 2017). Thus, waste management with proper techniques is needed for those countries. As a result, Ghana can however turn things around to recycle the waste into energy.

III. CONCEPTUAL FRAMEWORK

Drawing on the theoretical and empirical perspectives of waste management, this work presents a conceptual framework for the challenges that hinder waste management. A conceptual framework displays the complete research by classifying and stressing the elements, patterns, and relationships that exist between and among the study concepts (Kalaba, 2014). The conceptual framework of this study shows that the indicators of waste management practices have a significant impact on waste management in the oil and gas industry located in Takoradi. It also argues that all the dimensions have some level of impact on waste management. Figure 2.1 highlights three main issues that the oil and gas industry is faced with.

From the framework, it is lucid that to effectively manage waste there is the need to first know the types of waste generated. This is very much the case because various forms of waste are generated by various persons and entities. Thus, in managing waste it is very important for managers to first identify the types of waste generated to understand the best strategies to adopt. To this end, oil companies are required to know the types of waste they generate to be successful at managing them.

Moreover, after identifying the types of waste generated, stakeholders must develop strategies and methods to help effectively manage waste.

Closely following the methods is the investment in facilities. Facilities are very essential in successful waste management efforts. When facilities such as Anaerobic thermal desorption units (ATDU), wastewater treatment plants, air service facilities, port facilities, and hazardous waste treatment facilities are available, it promotes the management of waste. It should also be added that the type of facilities to invest in will depend,

among others, on the types of waste generated and the capacity of the managers. It should also be stressed that the oil and gas industries generate dangerous waste from their activities both offshore and onshore which needs special facilities to manage them.

Certain wastes generated from their activities like hydrocarbons, drill waste, cuttings from wells, and other seismic explosive activities need more advanced treatment facilities to prevent these wastes from being disposed of wrongfully and unlawfully into water bodies as well as the environment affect both plant and aquatic life. Thus, Figure 1 is premised on the conviction that with an awareness of the types of waste generated by oil companies, appropriate waste management methods coupled with the required facilities, oil companies can effectively manage waste for the accomplishment of their goal.

IV. METHODOLOGY

The study population consisted of 105 employees from two companies, Schlumberger Oilfield Services and Zoil Services Limited, both located in Takoradi. The sample size for the analysis was determined using Morgan and Krejcie's table for sample size determination, and a sample size of 83 was used.

Purposive sampling was used to target employees who are directly involved with the waste management operation of the two companies, and a simple random selection was used to gather accurate first-hand information and a general overview of the waste management and treatment techniques of the companies. The sample size was made up of employees who are engineers, technicians, health, and safety as well as operators who are directly involved with the waste management procedures. A total of 83 structured questionnaires were administered to all employees in the sample, with 40 from Schlumberger Oilfield Services and 43 from Zoil Services Limited. All questionnaires were retrieved, ensuring that the analysis is a true representation of what is on the ground. The data was analyzed using frequencies, percentages, means, standard deviation, and an independent samples t-test.

V. RESULTS AND DISCUSSION

Introduction

This chapter outlines the analysis of the data that was collected for the study. Questionnaires were self-administered to employees of selected staff of Schlumberger Base inside Takoradi Port and Zoil Ghana Limited at Inchaban in the Western Region of Ghana. These selected staffs have in-depth knowledge of waste management. This phase also represents the analysis based on the objectives set for this research in chapter one. The chapter however first starts with the demographic backgrounds of respondents in the study.

VI. BACKGROUND CHARACTERISTICS

The background features considered in this study are sex composition, marital status, age, educational background, level of income, and nationality. A total of 83 questionnaires were administered to the field personnel for both Schlumberger Oilfield Services and Zoil Services Limited of which all 83 questionnaires were retrieved from the respondents.

The total response obtained about the sex of respondents of the study indicated that 67 of the respondents representing 80.7% were males whereas 16 of the respondents representing 19.3% were females. From the analysis, it can be concluded that the majority (80.7%) of the respondents were males. It is fair to indicate that the nature of the job does not favor most women as it is very difficult with the use of various chemicals. Generally, many women will not like to be exposed to such environments.

Education is key. It gives knowledge to people. However, it was recorded that a total of 47% of respondents were Degree holders, followed by 44.6% of respondents who had master's degrees. Finally, 8.4% of respondents were diploma holders. This indicates that the educational level of many of the respondents was generally high. The respondents are also knowledgeable in managing waste. It also gives the view that

training a highly skilled and efficient workforce in managing waste is very possible considering their educational background.

Moreover, 89.2% of respondents were all Ghanaians. A total of 10.8% of respondents were non-Ghanaians. This indicates that both Schlumberger Oilfield Services and Zoil Services Limited are made up of multinationals and professionals from different countries who will bring expertise and technical know-how to the waste management process. This is likely to allow for knowledge transfer from the different and experienced workforce who will bring on board different waste management approaches. Ghanaians can then learn from them to improve their waste management processes.

VII. RESOURCE FROM WASTE GENERATION

It can be observed from Table 1. that we can generate resources from waste if it is managed well. These resources could be a result of recycling, rubber production, fertilizer, and landfills to talk about a few. From Table 4.6 it could be seen that seventy-eight (78) respondents out of 83 said yes, we generate resources from waste representing 94% whilst five (5) out of the 83 respondents representing 6% said no, resources cannot be generated from waste. However of the view that most of the respondents believe that with the right equipment and technical know-how, we can generate a lot of resources from industrial waste.

Table 1: Resource from waste generation

Response	Frequency	Percent
Yes	78	94.0
No	5	6.0
Total	83	100.0

Source: Field Data, 2020

VIII. HOW LONG HAVE YOU MANAGED WASTE IN THE COMPANY

From Table 2. the analysis indicates how long waste has been managed in Schlumberger and Zoil Services Limited. Out of a total of 83 questionnaires that were administered, sixty-seven (67) of them represent 80.7% which is most respondents have had more than five (5) years of experience in managing waste in the company. Eleven (11) respondents representing 13.3% have also had three (3) years of experience in managing waste. A total of two (2) respondents representing 2.4% have also had two (2) years of experience in managing waste whereas a total of three (3) respondents representing 3.6% have also had one (1) year of experience in managing waste. From the data, it is however evident that a greater percentage of the respondents have been able to manage waste for more than five (years). This shows clearly that most of the respondents have had enough experience, adequate know-how, training, competence, and exposure to managing waste.

Table 2: How long respondents have managed waste in their company

Response	Frequency	Percent
1 Year	3	3.6
2 Years	2	2.4
3 Years	11	13.3
Above 5 Years	67	80.7
Total	83	100.0

Source: Field Data, 2020

IX. EXPLORING THE TYPES OF WASTE GENERATED IN THE OIL AND GAS INDUSTRY

The first objective of this research was to ascertain the types of waste generated in the oil and gas industries in Ghana. Feedback from respondents was obtained and presented in Table 4.12. In analyzing data obtained for this objective, a scale of 4 to 1 was used; 4 representing Strongly Agreed (SA), 3 representing Agree (A), 2 representing Disagree (D), and 1 representing Strongly Disagree (SD). Concerning the generation of hydrocarbon waste from oil and gas production in the companies, the study revealed that such waste was generated by them as confirmed by a mean score of 2.600 and a standard deviation of 1.13. The analysis also revealed and agreed that used containers and oily rags are the main types of waste generated with a mean of 3.60 and SD of 0.65. The respondents also agreed that sludge and wastewater with a mean of 3.27 and SD of 0.80 is another major waste generated by the companies. Respondents however disagreed that ballast water and waste from explosive activities with means of 2.01 and 2.00 and SD of 1.03 and 1.02 respectively were not generated by the activities of these companies.

Table 3: Types of waste generated in the oil and gas industry

Type of waste	Mean	Std. deviation
Hydrocarbon waste from oil and gas production	2.600	1.13735
Expired chemicals for drilling activities	2.3735	1.23674
Hazardous chemicals from Tank cleaning activities	2.500	1.16176
Ballast water	2.0120	1.02997
Used containers and oily rags	3.600	.64756
Sludge and wastewater	3.2771	.80112
Waste from explosive activities	2.00	1.02137
Average responses	2.6000	1.00512

(Source: Field Data, 2020)

X. EXPLORING THE METHODS USED BY THE COMPANIES IN MANAGING WASTE GENERATED

The second objective of the research was to explore the methods used by the companies in managing waste generated; Views from respondents were obtained and presented in Table 4.10. with the keys provided below:

4=Strongly agree (SA)

3=Agree (A)

2=Disagree (D)

1=Strongly Disagree (SD)

It is evident from the analysis that some advanced treatment methods in managing waste presently such as disposal into salt caverns with a mean of 1.79 and a standard deviation of 0.91 and bioremediation with the use of bacteria (M=2.06, SD=1.11) are not practiced. However, from the respondents, landfilling and compaction /shredding with the highest means of 3.22 and 3.20 with standard deviations of 0.86 and 0.87 respectively are what is mostly practiced in both companies. The issue of whether the companies can convert their treated waste into useful energy came out from the respondents that a mean of 2.12 with an SD of 1.16 affirmed that both companies either lack the facilities or the technology to implement this waste treatment method.

Table 4: Methods used by the companies in managing waste generated

Method	Mean	Std. Deviation
Landfilling	3.2169	.85609
Oil-water separation technology	3.1205	.87510
Disposal into salt caverns	1.7952	.90741
Advance thermal treatments	3.0843	1.01459
Bio-remediation with the use of bacteria	2.0642	1.10817
Compaction/shredding	3.2048	.87196
Incineration	3.1446	.92568
Waste to Energy	2.1205	1.16239
Average responses	2.7188	0.96517

(Source: Field Data, 2020)

This, however, gingered Latif and Iskandar (2019, pg. 135) to posit that "education is fundamental to develop responsibility and awareness. Landfilled putrescible waste cause gas and leachate production. In Europe, the EU Directive 1999/31/EC on the landfill of waste has stimulated the diversion of organic matter to composting or specialized landfill sites, especially in the Netherlands, Sweden, Denmark, and Austria. Landfilling remains the most prevalent waste treatment and disposal method despite carrying the greatest threat to human health in addition to its proven negative impact on the environment. The form of landfill operations implemented in Ghana is often un-engineered open pit waste dumping with no leachate control, scant application of cover material, and open access to scavenging animals, rodents, and other diseases vectors (Tenkorang, Yeboah-Agyepong, Buamah, Agbo, Chaudhry and Murray, 2012).

XI. VIEWS OF EMPLOYEES ON THE EXISTING FACILITIES FOR WASTE MANAGEMENT IN THE COMPANIES

The third objective was to examine the views of employees on the existing facilities for waste management in the companies. Means and standard deviation were used for analyzing the data generated and the results are shown in Table 4.11. On the issue of whether facilities help in the storage of toxic and hazardous substances, the respondents moderately agreed that facilities helped in that regard based on a mean score of 3.50 and a standard deviation of 0.78. In effect, the study showed that the two companies had facilities that helped in storing toxic and hazardous substances. This result contradicts that of Ibem-Ezera (2010). In a study done by the author in Niger Delta, it was found that many of the facilities for the management of waste are obsolete.

Table 5: Views of employees on the existing facilities for managing waste

Role facilities play in the management of waste	Mean	Std. Deviation
Facilities help in the storage of toxic and hazardous substances	3.5060	.78668
Facilities are critical in the processing of toxic and hazardous waste	3.2530	.90854
Facilities are critical in the final disposal of toxic and hazardous waste	3.1807	.87156
Facilities help in the treatment and final disposal of domestic wastewater	3.3373	.80056

Facilities are used for the recovery and disposal of radioactive waste	2.3133	1.14687
Facilities are relevant in the recycling of waste materials	2.9759	.71527
Average responses	3.0943	0.87158

(Source: Field Data, 2020)

Concerning whether the companies had facilities for processing toxic and hazardous waste, the researcher observed that indeed the two companies had those facilities which helped in achieving (M=3.25, SD=0.90). This is supported by a mean score of 3.25 and the corresponding standard deviation of respondents was obtained and presented in Table 4.11. In Ghana, several serious and highly publicized pollution incidents associated with incorrect waste management practices led to public concern about the lack of controls, inadequate legislation, and environmental and human health impact (Raj. Prasad and Bansal, 2006; Hossain, Santhanam, and Norulaini, 2011).

Furthermore, the findings of the study are in line with the sustainability theory which calls for the need to put in place measures to sustain the environment for human well-being. Implicit in the theory is the need for companies to effectively manage the waste they generate (Briassoulis, 2001). Thus, the measures these two Companies have put in place to manage waste help to reinforce the practical relevance of the theory.

The second part of the third objective was to determine the adequacy of this existing facility in managing waste in the companies. Views of respondents were obtained and detailed in Table 4.12 with the key's bel

4=Very Adequate (VA)

3=Moderately Adequate (MA)

2=Lowly Adequate(LA)

1=Inadequate (IA)

From Table 5, it can be seen that the companies have very strong facilities for the storage of toxic and hazardous substances with a mean of 3.35 and SD of 0.74 which indicates the companies have control of toxic and hazardous waste within their facilities and this prevents the release of these substances into the environment which is very harmful to human life as well as the environment. The companies also have very reliable facilities for processing toxic and hazardous waste with a mean of 3.02 and an SD of 0.91 which implies all toxic and hazardous wastes are well processed and managed in the companies. Also, facilities for ensuring the final disposal of toxic and hazardous waste with a mean of 2.88 and SD of 0.72 is very adequate from the respondent's point of view.

Table 6: Views on the level of adequacy of existing facilities for managing waste

Adequacy of the existing facilities in managing waste	Mean	Std. Deviation
Facilities for the storage of toxic and hazardous substances	3.3494	.73971
Facilities for processing toxic and hazardous waste	3.0241	.91032
Facilities for ensuring the final disposal of toxic and hazardous waste	2.8795	.72242
Facilities for the treatment and final disposal of domestic wastewater	3.1084	.88362
Facilities for recovery and disposal of radioactive waste	2.2169	1.10485
Facilities used in the recovery of waste materials	2.7590	.89156
Average responses	2.88955	0.88268

(Source: Field Data, 2020)

However, the respondents disagreed with the adequacy of the facilities for the recovery and disposal of radioactive wastes with a mean of 2.22 and SD of 1.10. Companies that are well-established build their facilities the enablement of efficient production and profitability. In Malaysia, in terms of facilities, "authorized companies which have a license that meets the standard requirement should handle the location for waste disposal. The standards in waste management for the oil and gas industry are already very high and are currently being implemented. Somehow facilities need to be enhanced as they are as important as the issue itself" (Latif and Iskandar, 2019). On the other hand, Ghana has generated enough funds from philanthropists in curbing the issues of waste. Environmental education on the other hand probes adequates attention to resolving waste issues. Basic education is needed in the life of every individual to help manage and eradicate waste for proper sanitation to prevail. Technology helps in advancing phenomena. The results of this study are in agreement with the environmental economics theory which sees technology and human advancement as essential in the management of the environment (Zhiqiang et al., 2001).

XII. WHETHER OR NOT DIFFERENCES EXIST IN THE VIEWS OF EMPLOYEES OF THE TWO COMPANIES CONCERNING THE ADEQUACY OF EXISTING FACILITIES FOR MANAGING WASTE

The fourth objective of this research was to examine whether or not there exist the views of employees of the two companies concerning the adequacy of the existing facilities for waste management waste. Independent samples t-test was conducted to compare the means of the two companies on the adequacy of facilities their companies have. Results from the analysis have been displayed in Tables 5 and 6.

Table 7: Group statistics

Differences in the adequacy of facilities	N	Mean	Std. Deviation	Std. Error mean
Schlumberger Oilfield services	40	47.36	0.744	3.145
Zoil services limited	43	32.11	0.641	2.481

(Source: Field Data, 2020)

Table 8: Independence samples t-test of the difference in the views of employees of the two companies concerning the adequacy of existing facilities for managing waste

	F	Sig	t	Df	Sig(2-tailed)	Mean difference	Std Error difference
Equal variances assumed	2.400	0.131	-3.142	8.000	0.214	-0.875	1.876
Equal variances not assumed			-3.712	7.000	0.162	-0.875	3.545

(Source: Field Data, 2020)

The first indicator to look out for is the mean values in the group statistics. Here it can be seen that on average Zoil services Limited has more facilities for managing waste than Schlumberger oilfield services (47.36 as against 32.11). Further, in determining whether the difference between

them is huge enough the independence samples t-test was conducted. SPSS reported a t-value of -3.142 and a 2-tailed p-value of 0.2 which is very significant to our study. The p-value of 0.2 is greater than the alpha value of 0.05. This shows that no differences exist in the views of respondents on the adequacy of facilities in the two companies. This analysis agrees with the null hypothesis that there is no difference between the variance of the two facilities.

XIII. CONCLUSIONS AND POLICY IMPLICATIONS

From the study, it is clear that different types of hazardous waste are being generated by oil and gas companies. These wastes could potentially negatively impact the environment if not well managed. Regarding methods of managing waste, it can be concluded that several methods are in place to effectively manage the waste generated by the activities of these companies. However, it is important to note that other waste management technologies should be adopted to effectively manage these wastes. A skilled and experienced workforce is required to implement these waste management technologies.

Concerning the existing facilities and the accuracy of these facilities, the researchers concluded that indeed the companies have different facilities to manage their wastes. However, some of the facilities were obsolete and so the companies need modern facilities that can effectively manage the generated waste. No differences exist in the views of respondents of the two companies in terms of adequacy of facilities though the activities of Schlumberger are somewhat different from that of Zoil from that of Schlumberger. These wastes are gathered and sent to Zoil for the actual waste treatment to take place. Thus, it is clear that Zoil will have good facilities for managing waste because its actual mode of operation is waste management. In general, waste has been effectively managed in these two companies. Some of the obsolete facilities need critical attention. It is important to train the employees to give them more insight into their core mandate to effectively manage their waste.

Based on the key findings and conclusions, it is recommended that the management of the two companies should train and retrain employees on their mode of operation and put other waste treatment methods from other countries. Training gives more understanding of the key processes and better implementation. In addition, the management of the two companies should invest in the maintenance, re-design, and re-engineering of their facilities to fit modern waste treatment methods and procedures. This will help reduce the exposure of this toxic and hazardous waste to the environment. Again, management should ensure there is the revision of procedures to enable the companies to the current and modern waste management procedures. The revision will also get rid of non-production time as well as waste in the system for effective implementation. Finally, the companies should adopt current waste treatment methods like bioremediation with the use of bacteria which employs bacteria to eat up all the solid waste generated over some time. Energy waste is also a very good way of managing waste which converts waste into more useful energy for income generation.

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