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Waste Disposal Mitigation Strategies in Oil and Gas Institute Delta State, Nigeria

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ABSTRACT: This study evaluates waste disposal mitigation strategies in Oil and Gas Institute Delta State, Nigeria. The study Objectives were to evaluate general waste management strategies adopted by Oil and Gas Institute Delta State, Nigeria, to ascertain waste disposal mitigation strategies inherent within the institute and to assess the current state of waste generation and disposal practices in the Institution. The study was conducted within Oil and Gas Institute Delta State, Effurun through a direct survey where a detailed questionnaire was used as a survey tool to evaluate the knowledge and attitude of students and staff towards waste minimization as an effective waste disposal mitigation strategy. Findings revealed that respondents were majorly students with a distribution of 69 persons as against 25 randomly selected staff. Results from the study showed non-implementation to waste disposal mitigation strategies of 3.3-Staff and 3.1-Student response. However, findings further showed that respondents (students (3.2) and staff (3.6)) are aware of waste management strategies and educated on waste management. Despite awareness levels, average response of 2.5-students and 2.8-staff indicated non-compliance with waste management. Inspection of the tertiary environment, reports on average ratings (3) on implementation of food waste reduction measures, together with the absence of documentation of hazardous waste management and non-exploration of renewable energy. It can therefore be concluded that the existing waste management policies and waste management education programs are not adequate for improving waste disposal mitigation in Petroleum Training Institute. Based on this, several measures were recommended to be put in place in order to improve waste disposal mitigation in the institution, including recycling programs, Inculcation of Improved educational programs on source reduction and waste Minimization, Composting programs and others. A clear and well-defined policy should be established to ensure monitoring of compliance with the newly implemented mitigation strategies.

Keywords: Well-defined policy, Waste, Strategies, Oil and Gas Institute Delta State
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INTRODUCTION

Industrialization and urbanization have overtime resulted in production of waste in both developed and developing nations. To many, these materials are considered as nothing but unwanted products thus incurring major environmental problems that many countries are faced with today, hence necessitating the need for waste management (Hossein, Nastaein and Parsa, 2016). According to Nabegu in 2010, an estimated 3.4 - 4billion tons of municipal and industrial solid wastes and up to 300 million tons of hazardous waste are produced annually worldwide. As stated by the United Nations Environmental Programme (2011) the continuous mis-management of these waste materials invokes environmental and human health risks, ecosystem degradation, contamination of soils and water, as well as global warming. In a developing nation such as Nigeria, wastes are frequently found disposed along the streets, gutters, drainage channels, rivers, abandoned plots of land amongst other (Ohimain, 2013). As compared to developed nations, management of these wastes is a complete opposite of what is experienced leading to severe environmental issues including soil and water contamination.

At the moment, waste mismanagement events have

engulfed almost every urban area in Nigeria including tertiary institutions since student disciplinary problems has always included indiscriminate disposal of wastes (OKoye, Onyali and Ezeugbor, 2015). Within academic environment, solid, liquid and gaseous substances (emanating from dietary habits, lifestyles, living standards, the degree of urbanization and industrialization) are constantly produced. While waste management strategy has been focused on within household, its importance in academic environment has not been fully explored despite the infusion of environmental education into academic curriculums (Dunk, Mankili and Ozoji, 2018).

Waste disposal mitigation strategies are targeted not only on disposal of waste around institutions but also on intervention strategies needed to maintain or change a particular behavior (Desa, Kabir and Yusooff, 2012). The lack of waste disposal strategies in academic environment could truncate health of students and quality of environment. Dunk *et al.,* (2018) described the absence of disposal of waste to likely create unsanitary conditions, and these conditions which in turn can lead to pollution of the environment and the outbreak of vector-borne diseases.

This situation has been and continuously reduces environmental capacity to sustain life. It is hence important to establish waste disposal mitigating strategies. Existing waste disposal strategies implemented in tertiary institutions in Nigeria are either void or remains significantly low. As a result of this, concerns posed by wastes disposal have not fully been reviewed most especially in academic environment within Nigeria. It is therefore important to undertake this study. The aim of this study is to evaluate waste disposal mitigation strategies.

Literature review

Waste

Any gaseous, liquid, or solid substance that is discarded because the owner has used it up is referred to as waste. Waste is produced by human activities in many different sectors all around the world (Brunner and Rechberger, 2014). Waste is still a big source of concern today. This occurs as a result of the current rise in trash volume brought on by urbanization and population growth. As a result, there is an increase in indiscriminate littering, open dumps, breeding grounds for rats and other vermin, and serious dangers to public health owing to contaminated soil, water, and air (Amasuomo and Baird, 2016). Wastes are characterized on the basis on their sources, types, generation rates and composition (Alam and Ahmade, 2013). These wastes pose certain characteristics such as reactivity, toxicity, ignitability and corrosiveness.

Categories of waste

Waste materials originate from industrial and mining study, agriculture and livestock from residential, commercial and municipal activities in urban areas. They are often classified based on certain criteria which include;

Physical nature: this is a classification of waste based on its state of existence. These are;

Liquid: liquid waste can be defined as such fluids as waste water, fats, oil or grease used oil and hazardous household liquids

Solid: Solid waste is defined as nuisance, unwanted or discarded material with insufficient liquid content or gas for free movement.

Gaseous: Gaseous waste is defined as uncontrolled airborne emissions and effluents. These emissions consist of gas, mist, smoke, vapour matter, fumes or any combinations.

Origin: this is a classification of waste based on their sources. These sources include household/domestic waste, industrial waste, agricultural waste, commercial waste, demolition and construction waste and Mining waste.

Environmental impact: this is a classification based the likely environmental impact. They are grouped into hazardous and non-hazardous waste (Amasuomo and Baird, 2016).

Types of waste generated

Educational institutions, including universities, colleges, and technical training centers like Oil and Gas Institute, Delta State, generate a variety of waste types, which may include but are not limited to:

General Solid Waste: This comprises everyday waste such as paper, food waste, packaging materials, and non-recyclable items.

Hazardous Waste: Educational institutions often produce hazardous waste from laboratories, maintenance, and other activities. This can include chemicals, electronic waste, and other potentially harmful materials.

Biological Waste: This includes items like used medical or laboratory supplies, which may carry biological risks.

E-Waste: As technology is integral to education, electronic waste, such as old computers, monitors, and

other electronic devices, can pose disposal challenges.

Recyclables: Items like paper, cardboard, plastics, and certain electronic devices can be recycled.

Construction and Demolition Waste: If an institution is undergoing construction or renovation, this type of waste may be generated.

Specialized Waste: Some educational institutions may produce specialized waste related to their fields, such as hazardous chemicals in science and engineering schools.

Environmental and Health Implications

Improper waste disposal in educational institutions can lead to a range of environmental and health concerns, including:

Pollution: Poor waste management can result in the release of hazardous substances into the environment, contaminating soil, water, and air.

Health Risks: Exposure to hazardous waste materials can lead to health risks for students, faculty, and staff. It may cause respiratory issues, skin conditions, and other health problems.

Aesthetic and Nuisance Issues: Accumulation of waste can lead to unsightly campus conditions and odors, negatively impacting the quality of life for everyone on campus.

Municipal solid waste

Municipal solid waste is made up of commonplace goods such product packaging, yard garbage, furniture, clothing, bottles and cans, food, newspapers, appliances, electronics, and batteries (USEPA, 2018). Residential garbage (including waste from multi-family dwellings) and waste from commercial and institutional facilities, such as businesses, schools, and hospitals, are sources of municipal solid waste. Municipal solid trash does not, however, contain building and demolition debris, hazardous materials, or industrial waste. Municipal solid trash must be generated, collected, and managed to prevent environmental problems. Recycling, composting, burning with energy recovery, and landfilling are common management techniques. Worldwide, rapid urbanization, rising populations, and rising living standards have led to a significant increase in solid waste. Industrialized nations generate more solid waste in urban areas than underdeveloped nations do, yet the latter's municipal solid waste management is still insufficient. The type, density, and structure of the waste produced varies in developing nations like Nigeria (Samah et al., 2013). According to Ogwueleka (2009), this is a significant issue regarding waste management because local governments spend between 79% and 75% of their revenue on collection and the remaining percentage on disposal, but they can only collect between 50% and 70% of municipal solid trash. The main cause of this is the way garbage is disposed of.

Municipal waste disposal practices in Nigeria

In Nigeria, municipal solid wastes are frequently disposed along the streets, gutters, drainage channels, rivers, abandoned plots of land (Ohimain, 2013). Poor waste disposal has been linked to blockage of gutters and other drainage channels causing flood, poor aesthetics, release of foul odour and greenhouse gases, obstruction of traffic flow and pollution of surface and ground water (Abah and Ohimain, 2010).

Municipal solid waste disposal is treated with levity in developing countries of the world, most especially in Nigeria which has experienced high rate of urbanization within the last four decades. The nonchalant attitude of people in African countries (especially Nigeria) toward modern methods of waste disposal has posed serious environmental health challenge to human existence in their natural environment (Afangideh *et al.,* 2012). Waste disposal practices is hugely influenced by Inadequate and non-existence of accredited waste collection points in the neighborhoods of many urban centers in Nigeria (Adetunji *et al.,* 2015) which has resulted in open dumping practices. As reported by Adetunji *et al.,* (2014) this negative waste disposal practice has resulted in household health changes with percentage of diseases (Malaria 54.5%, Dysentery 40.7% and Cholera 4.8%) experienced. Open dumping of waste cannot be considered as a long-term environmental method of disposal (Ogwueleke, 2009). The dangers of open dumping are many; health hazard to scavengers at the dump site, pollution of ground water, spread of infectious diseases, highly toxic smoke from continuously smouldering fires and foul odours from decomposing refuse.

Waste mitigation

Waste mitigation plays a crucial role in minimizing the environmental impact of waste generation and promoting sustainable resource management. There are several waste mitigation strategies including source reduction which involves practices such as product design improvements, material substitution, and process optimization to reduce waste at its source, recycling and composting amongst others (EPA, 2021). Studies have highlighted the environmental benefits of waste mitigation including energy savings, reduced greenhouse gas emissions, and conservation of natural resources (Nnorom *et al.,* 2018). Other scholars posit that waste mitigation has the potential of increasing economy benefits

as it aim to maximize resource efficiency and minimize waste generation (Piscicelli *et al.,* 2021). Waste mitigation strategies covers a wide range of areas and play a vital role in achieving sustainable waste management practices.

Waste management strategies in Nigeria

Public engagement and knowledge are required for all aspects of waste management, including trash storage, waste segregation, recycling, frequency of collection, willingness to pay for waste management services, and opposition to the placement of waste treatment and disposal facilities (Ernest, 2017). Akinbile (2012) asserts that the rise in human population, as well as the industrial and technological revolutions, have made waste management more complex. Diverse tactics/strategies are incorporated into trash management to lower waste availability in Nigeria. The frequently used waste management methods in Nigeria include; incineration, sanitary landfill, and pyrolysis.

Incineration: It is a controlled combustion process for burning solid wastes in presence of excess air (oxygen) at high temperature of about 1000^{o}C and above to produce gases and residue containing non-combustible material. One of the most attractive features of the incineration process is that it can be used to reduce the original volume of combustible waste by 80– 90%.

Pyrolysis: Pyrolysis is defined as thermal degradation of waste in the absence of air to produce char, pyrolysis oil and syngas. In pyrolysis, an external heat source is employed in this process. This is because most organic substances are thermally unstable and can upon heating in an oxygen-free atmosphere be divided through a combination of thermal cracking and condensation reactions into gaseous, liquid and solid fraction.

Landfill: The practice of landfill system as a method of waste disposal in many developing countries is usually far from standard recommendations. Landfills have been identified as one of the major threats of ground-water resources. Most importantly, the groundwater located near the landfills or dumpsites is highly polluted due to the leachate produced from it (Kamble and Saxena, 2017). However, there are other management methods which have proven useful in minimizing waste such as source reduction/waste mitigation. Source reduction focuses on reducing the generation of waste at its source.

This method aims to prevent or minimize waste generation through practices such as reducing packaging materials, using durable products, and promoting reusability. By minimizing waste generation, the overall volume of waste requiring management is reduced.

Waste mitigation in Nigeria

Compared to different waste management practice employed in developed nations, waste mitigation strategies employed in Nigeria are rather different. Notable waste mitigation strategies employed in Nigeria include recycling not only reduces the volume of waste requiring disposal but also minimizes the exploitation of natural resources and reduces pollution from waste accumulation (*Ezeah et al.,* 2013). Ezeah *et al.,* (2013) also stated the application of public awareness that increases the knowledge and changing behaviors of individuals and waste to energy generation.

Odeyemi *et al.,* (2016) on their study examined the role of informal waste management practices in waste mitigation in Nigeria. Results showed the benefits of informal waste pickers and their contribution to recycling and resource recovery. This strategy mitigates waste by minimizing waste volumes around communities.

Waste mitigation in tertiary institutions in Nigeria

Waste mitigation in tertiary institutions in Nigeria is crucial for promoting sustainability, reducing environmental pollution, and creating a clean and healthy campus environment. Findings by Adewale *et al.,* (2017) revealed that encouraging the use of recyclable, biodegradable, or compostable materials can significantly reduce the amount of waste generated on campus.

Idowu *et al.,* (2019) on the study on perception and practices of waste management among students in Nigerian tertiary institutions showed that educational campaigns and workshops can promote responsible waste disposal, recycling, and the importance of reducing waste generation through sustainable consumption practices. Their study showed that absence of waste management campaign is a reason for reduced waste mitigation amongst students. Nwachukwu *et al.,* (2020) also reported that waste audits can inform the development of waste management plans such as waste mitigation that address specific waste challenges and prioritize waste reduction, recycling, and proper disposal.

Types of Mitigation Strategies

Waste Minimization: This approach focuses on reducing the quantity of waste generated at the source. It includes practices like source reduction, recycling, and reusing materials to decrease the overall volume of waste.

Waste Diversion: Strategies in this category aim to divert waste away from landfills. This can involve initiatives such as composting organic waste, recycling materials, or repurposing items, reducing the environmental impact of disposal.

Efficient Waste Handling: This strategy emphasizes the

efficient handling, storage, and transportation of waste to minimize environmental and health risks. Proper containment, labeling, and safe transport methods are critical components.

Technology-Based Solutions: Innovations in waste treatment and disposal technologies play a crucial role in mitigating waste. Advanced treatment processes, including waste-to-energy technologies and environmentally-friendly waste treatment facilities, can significantly reduce the environmental impact of waste disposal.

Policy and Regulatory Measures: Government or institutional policies and regulations often drive waste mitigation efforts. These can include regulations promoting responsible waste management practices, waste reduction targets, and incentives for sustainable waste practices.

Effectiveness of Mitigation Strategies

The effectiveness of these mitigation strategies varies based on the specific context, goals, and resources available. Research and case studies have shown that when implemented correctly, these strategies can:

- Reduce the volume of waste generated, resulting in cost savings.
- Minimize environmental contamination and health risks.
- Contribute to sustainability goals by conserving resources and reducing greenhouse gas emissions.
- Foster a culture of environmental responsibility within institutions or industries.

Integration into Educational Institutions

Waste disposal mitigation strategies can be tailored and integrated into the context of educational institutions like the Oil and Gas Institute Delta State. In an educational setting, these strategies offer various benefits:

- Enhance sustainability education and awareness among students, fostering responsible environmental practices.
- Reduce operational costs through waste reduction and recycling initiatives.
- Improve the institution's environmental footprint and reputation.
- Provide real-world case studies for students and staff to learn about practical waste management and sustainability efforts.

Challenges and Limitations

Challenges associated with implementing waste disposal mitigation strategies may include:

- Initial implementation costs.
- Resistance to change and the need for behavioral shifts.
- Balancing environmental goals with financial constraints.
- Ensuring consistent compliance with waste management practices.

By addressing these challenges, institutions and industries can develop effective waste mitigation strategies that lead to environmental responsibility and sustainability.

METHODOLOGY

In this study, direct survey was adopted where a detailed questionnaire was used as a survey tool in the assessing knowledge and attitude of students and staff towards waste disposal mitigation strategies. This enabled accuracy in optimization of primary data for the research study. A detailed checklist was also adopted in evaluation general waste management strategy.

Demographic Description of Oil and Gas Institute Delta State

The Oil and Gas Institute Delta State is an educational institution specializing in the training and education of students and professionals in the field of petroleum, oil, and gas. Demographically, the composition of Oil and Gas Institute Delta State can vary over time and might include the following elements:

Location: Oil and Gas Institute Delta State is situated in Effurun, a town in Uvwie Local Government Area of Delta State, Nigeria.

Region: Effurun is located in the southern part of Nigeria, which is part of the Niger Delta region. It is known for its significance in the country's oil and gas industry.

Population: Delta State has a diverse population with various ethnic groups, including the Urhobo, Itsekiri, Isoko, and Ijaw, among others. The population of Effurun itself may vary, but it is a bustling urban area with a mix of residents, including students, faculty, and staff associated with Oil and Gas Institute Delta State.

Economic Activity: The region is economically significant due to its proximity to the oil-rich Niger Delta. The oil and gas industry play a major role in the local and national economy.

Infrastructure: Effurun and its surroundings have infrastructure and amenities that support the needs of the

Oil and Gas Institute Delta State community, such as transportation, housing, and commercial services.

Students: Oil and Gas Institute Delta State, primarily consists of a diverse student body. Students may come from different regions, both within Nigeria and internationally, with varied backgrounds and experiences. They can be young individuals fresh out of secondary school or mid-career professionals seeking further education and training in the petroleum industry.

Faculty and Staff: Oil and Gas Institute Delta State employs a mix of experienced educators, researchers, and industry professionals. Faculty members might include instructors with expertise in various fields related to petroleum and energy, such as geology, drilling, refining, and environmental management. Administrative and support staff contribute to the smooth operation of the institution.

Age Groups: The age distribution at Oil and Gas Institute Delta State is diverse, reflecting the varying age groups of students and staff. The institution accommodates students who are typically in their late teens or early twenties as well as older students pursuing further education or retraining for career transitions.

Educational Background: Students at Oil and Gas Institute Delta State come from different educational backgrounds. Some may have completed secondary education and are pursuing their first academic qualification, while others may have existing degrees and experience in fields related to petroleum.

Marital Status: The marital status of students and staff may vary. Some individuals may be single, while others may be married or divorced. Marital status can influence the responsibilities and commitments of individuals within the institution.

Approach

Random sampling of respondents within the study area was conducted and sufficient number of respondents sampled. Random sampling was used because it eliminates any form of segregation. The sampling included students and staff administered with the research tool in a self-completion format. Additionally, visual inspection was also conducted to evaluate waste management strategies.

Data sources

Data sources for this research includes both primary and secondary data:

Primary Data: Primary data was collected through interviews within the institute “Oil and Gas Institute Delta State” Surveys questionnaires were distributed to students and staff. These primary sources would provide firsthand information about the institute “Oil and Gas Institute Delta State” waste disposal practices and stakeholders' perspectives.

Secondary Data: Secondary data encompasses existing literature, reports, and documents related to waste management and mitigation strategies in educational institutions, with a specific focus on the petroleum sector. Secondary data sources will help provide a broader context and background for the study.

Data collection method

Data collection was done by careful analysis of answered questionnaire from respondents. Primary sources of data technique were adopted because it involves the extraction of information from the field of investigation in order to get first-hand information. Response was tabulated as primary data and cross examined for consistency and accuracy to ensure efficiency of result.

Data analysis

Data cross tabulated was analyzed to ascertain average response using relevant statistical methods.

RESULTS AND DISCUSSION

Demography of respondents

Table 1 shows the demography of Respondents (Students and Staff). Assessment of the demography of respondents indicated that respondents were majorly students with a distribution of 69 persons as against 25 randomly selected staff. This result reveals that academic institutions comprise mainly of students which means that students are likely to contribution of major part of waste generated and disposed within the institutions and constitute more awareness of the kind of waste disposal mitigation strategy they are exposed to. Study by Dera *et al.,* (2012) on environmental awareness and education showed they necessity of provision such environmental information to both staff and students and the need for their inclusion in this study.

Distribution study showed that there was more female staff (56%) than male staff (44%) while more male students (57%) that female students (43%) (Table 1). Table 1 also showed that all respondents were adults and hence meet the criteria level for the study which showed that they are likely to provide accurate response on waste disposal mitigation. Respondents also have a minimum educational level of SSCE and HND for students and staff respectively.

Table 1: Demography of respondents (Students and Staff).

Demography		Staff	Percentage Distribution	Students	Percentage Distribution
Gender	Male	11	44	39	57
	Female	14	56	30	43
Age	18 - 23	1	4	40	58
	24 - 27	2	8	23	33
	28 - 35	17	68	15	22
	36 and above	5	20	0	0
Mariat Status	Single	8	32	67	97
	Married	16	64	1	1
	Divorced	1	4	1	1
Educational Level	OND	0	0	41	59
	HND	2	8	27	39
	BSc	15	60	1	1
	MSc	8	32	0	0
	Others	0	0	0	0

Table 2: Average results of response on waste disposal mitigation.

Categories	Staff	Students
Waste Disposal	3.3	3.7
Knowledge and attitude towards waste management	3.6	3.2
mitigation strategies	3.3	3.1

Response on waste disposal mitigation

Results from (Table 2) of the study showed non-implementation of waste disposal mitigation strategies and its consequences around the tertiary institutions. Agreed response (staff-3.0 and students-3.8) on the indiscriminate littering of the institution environment with wrappers from junk food was observed. Regrettably, this has been counted as a major factor which drastically deface the environmental outlook of the school and affect health status of the students and staff in the school. this shows that absence of education on reduction strategy amongst staff and students alike. Although response showed that waste collection and disposal were actively conducted within the institutions with appropriately designed waste collection route for vehicle (3.7), high volume of waste generated does not portray active environmental education as it regard waste mitigation (Table 2). Solid waste management activities in the institution ought to involve the students and staff as part of their learning process. Response from both students (3.2) and staff (3.5) showed that they are aware of waste management strategies and educated on waste management. This response can be attributed to the implementation of waste management within student curricula and seminars for staff. However, average response of 2.5-students and 2.8-staff indicated non-compliance with waste management. This can be attributed to the fact that waste management education provided was not adequate as well as negligence on the part of both staff and students. Study by Dung *et al.,* (2018) supports this claim indicating that low level knowledge contributes to non-compliance with appropriate waste management.

Response indicated that both staff and students are aware and well educated on waste mitigation which may have been embedded in waste management trainings. Despite this environmental waste management trainings, staff and students revealed that the institute has not incorporated appropriate waste mitigation strategies. Response also showed that waste reuse strategies and waste behavioural inspections are not conducted/implemented to minimize waste disposal amongst students and staff. To curb the ongoing increase in disposed waste volume, both sets of respondents agreed to the need for the institutional framework.

Waste disposal mitigation

One very important issue regarding waste disposal mitigation is the ability of the individuals to assimilate and interpret the information gained from waste management education. Categorically, waste disposal culture can only be effective under conditions where there exists an effective framework that promote environmental consciousness. Results obtained from safety inspection showed that waste audit is actively conducted to identify waste sources and quantities in addition to conduct of waste training program. Excellent rating also revealed that the institution emphasizes on the use of electronic devices to reduce waste generation. However, low poor rating scores (1) showed that staff/students are not educated and encouraged on the essentials attached to reusable materials and implementation of waste

Table 3: Average Result on Waste Disposal Mitigation in the Institute.

Category	Rating
General Management	3
Hazard Waste Management	4.6
Energy Efficiency and Conservation	2.8
Water Conservation	2.3

management policies (Table 3). Average ratings (3) also showed that food wastes reduction measures are not implemented despites vast knowledge on food waste constituting a major problem in the institution waste volume. Findings from inspection of the institute waste management record also showed that hazardous waste management is not documented which reveals the possibility of improper waste management and environmental deterioration. Waste disposal encompasses energy wastage. Assessment of the institution showed that measures to mitigate wastage as it relates to energy has not been adopted. Findings show that renewable energy sources are not explored (2), energy audits are not conducted (1) and energy consumption are not evaluated to minimize energy wastage (2).

In terms of waste conservation, average score of 2.3 showed that waste conservation strategy is not put in place around the institution (Table 3).

Key Insights

The research on waste disposal mitigation strategies at the Oil and Gas Institute Delta State has yielded several key insights that provide a comprehensive view of the state of waste management practices, awareness, and demographic influences within the institution. These insights are instrumental in shaping the conclusion of this research:

Demographic variations: The study highlighted notable variations in waste management practices and awareness among students and staff, largely influenced by demographics such as gender, age, educational level, and marital status.

Waste disposal practices and awareness: The average results for waste disposal practices indicated that students rated their practices slightly higher than staff. This may be because the number of students sampled was higher than staffs sampled, while staff members demonstrated better knowledge and attitudes toward waste management mitigation strategies, which may be attribute to age factor, educational level and experience over students. The result suggests the presence of room for improvement in both knowledge and practices.

Institutional waste management: Oil and Gas Institute Delta State showed strengths in hazardous waste management practices, as indicated by the high rating in this category. However, there is room for improvement in general waste management, energy efficiency, and water conservation practices. These findings underscore the potential areas for enhancement in the institution's waste disposal mitigation strategies.

Contributions to knowledge

This research contributes to the existing body of knowledge on waste disposal mitigation strategies, particularly within the context of educational institutions specializing in the petroleum industry. The key contributions are as follows:

Demographic Influences: The research provides valuable insights into how demographics, including gender, age, educational level, and marital status, shape waste management practices and awareness. These findings offer a nuanced understanding of the factors influencing waste disposal behaviors within an educational setting.

Recommendations for improvement: The research offers a set of actionable policy and educational recommendations for Oil and Gas Institute Delta State to enhance its waste management practices, awareness initiatives, and sustainability efforts. These recommendations are based on the specific challenges and opportunities identified within the institution.

Insights for Educational Institutions: The study's findings can serve as a valuable reference for other educational institutions, particularly those with a focus on the petroleum industry. They can draw upon the recommendations and insights to improve their own waste management strategies.

Conclusion

The research has shed light on the current state of waste management in Oil and Gas Institute Delta State, identified challenges, and proposed a comprehensive set of mitigation strategies. The critical importance of responsible waste management and environmental sustainability was highlighted, not only as ethical

imperatives but as essential components of Oil and Gas Institute Delta State reputation and responsibility within the petroleum industry. The findings from the demographic analysis underscore the diverse composition of Oil and Gas Institute Delta State community, encompassing students, faculty, and staff from various backgrounds, ages, and levels of expertise. The waste disposal mitigation strategies detailed in the study presents a roadmap for Oil and Gas Institute Delta State to address its waste management challenges comprehensively. These strategies encompass waste segregation and collection, recycling initiatives, hazardous waste management, energy efficiency and conservation, water conservation measures, educational programs, policy integration, behavioral change initiatives, and an implementation plan. Based on the findings of the study, it can be stated that both staff and students had agreed response to questionnaire items with average results (staff-3.3, students-3.7), (staff-3.6, students-3.2), (staff-3.3, students-3.1) on waste disposal, knowledge and attitude towards waste management and mitigation strategies. Findings revealed inadequate education on waste management, negligence on waste disposal and absence of incorporation of appropriate waste mitigation strategies. Inspection results also showed that the aforementioned factors had a significant relationship existing between waste management policies especially as it regards waste disposal mitigation strategy such as use of reusable materials. It can therefore be conducted that the existing waste management policies and waste management education programs is not adequate in improving waste disposal mitigation.

Recommendations

In light of the research findings and the proposed mitigation strategies, the following recommendations are made:

- Oil and Gas Institute Delta State should prioritize the implementation of the proposed mitigation strategies without delay. This includes the establishment of designated waste disposal areas, the development of recycling stations, and the launch of awareness campaigns.
- The waste management education program should be evaluated to improve its impact in the institution as it regards waste disposal mitigation.
- Environmental awareness programs should be conducted to raise awareness on the need for using reusable materials and its effect in waste reduction.
- The institution should conduct regular audits to assess the effectiveness of the strategies. These audits will ensure that Oil and Gas Institute Delta State remains on track to meet its waste management and sustainability goals.
- Oil and Gas Institute Delta State should explore partnerships with local recycling centers, waste management companies, and environmental organizations to enhance the execution of its strategies and promote sustainability.
- Active engagement of students is key to the success of the mitigation strategies. The institution should encourage students to take leadership roles in environmental initiatives, participate in research study's, and contribute to the culture of sustainability.
- Oil and Gas Institute Delta State must ensure that educational programs, workshops, and courses related to waste management and environmental responsibility remain an integral part of its curriculum. These initiatives should be continually updated and improved.
- Environmental and waste management policies must be enforced consistently across the institution. Strict adherence to these policies, along with regular inspections, is crucial for success.
- The institution should monitor and evaluate the impact of behavioral change initiatives and adapt them as necessary to foster a culture of environmental responsibility among students and staff.

The successful implementation of these waste disposal mitigation strategies will not only enhance Oil and Gas Institute Delta State environmental responsibility but also elevate its reputation within the petroleum industry. By addressing its waste management challenges proactively, Oil and Gas Institute Delta State will set a positive example for responsible waste disposal and sustainability practices. This research serves as a foundation for Oil and Gas Institute Delta State to embark on a path toward environmental stewardship, while contributing to the larger goal of environmental preservation within the petroleum industry.

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