
EXAMINATION OF THE INFLUENCE OF COMPLIANCE, HEALTH AND SAFETY AUDITS ON THE CONTROL OF GREENHOUSE GAS EMISSIONS FOR GOOD HEALTH OF THE PEOPLE IN LAGOS STATE

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ABSTRACT

The study examined the influence of compliance, health and safety audits on the control of greenhouse gas emissions for good health of the people in Lagos State. Two specific objectives, two research questions and two null hypotheses were formulated to guide the study. Descriptive and explanatory research design was used for the study. The population of the study consisted of all the sample locations which are due for this test as well as environmental management scientist from the Ministry of Environment, medical professionals from the Ministry of Health and dwellers in dump sites. A non-proportionate stratified sampling technique was used to obtain the study samples where the sample locations were randomly selected. Data for this work were obtained from both primary and secondary sources. The primary sources included field and laboratory experiments using such equipments as the sensitive gas chromatograph Mass spectrometer named MEDUSA. Secondary sources of data were obtained from the Ministries of Environment and Health in Lagos. The systematic random sampling technique was used to select three sampling locations within the dump site for greenhouse gas emission tests. A sensitive Gas Chromatograph Mass Spectrometer named MEDUSA was used in the measurement. It was concluded that there is no significant influence of compliance audit on greenhouse gas emissions [Carbon dioxide (CO₂), Methane (CH₄), Nitrous Oxide (N₂O), Ozone (O₃), Carbon monoxide (CO), Sulfur dioxide (SO₂)] at the Olososun dump site in Lagos State. There is significant influence of health and safety audit on health of the people in Lagos State. Therefore, it was recommended among others that auditors can increase impact by choosing topics that legislators and the public care about, such as health, the economy and jobs, the local environment and community, or the nation as a whole.

Key Words: Environment audit, Compliance audit, Health and Safety audit, Greenhouse gas emissions, Lagos State

Introduction

All over the world, there are series of environmental changes occurring in different countries. With environmental auditing, green house gas emissions as one of the major challenges faced by man will be minimized. It is recognized that the potential impact of greenhouse gas emissions on society and ecosystems may prove to be significant (Ekpoh, 2002). Our environment needs to be protected and that is why government has brought out policies that can help protect our environment for safety of human lives.

There are many strategies adopted by government to protect our environments. One prominent one is environmental auditing. Environmental auditing' is 'a management tool comprising a systematic, documented, periodic and objective evaluation of the performance of the organisation, management system and processes designed to protect the environment with the aim of facilitating management control of practices which may have impact on the environment, and assessing compliance with company policies' and the systematic examination of the interaction between any business operation and its surrounding. This includes all emissions to air, land and water legal constraints; the effects on the neighbouring community, landscape and ecology; and the public's perception of the operating company in the local area.

Many types of audit have been carried out by companies (ERM, 1996): These are compliance audit - the most common type of audit consisting of checks against environmental legislation and company policy; issues audit - an evaluation of how a company's activities relate to an environmental issue or (e.g. global pollution, energy use) or an evaluation of a specific issue (e.g. buildings, supplies); health and safety audit - an assessment of risks and contingency planning (sometimes merged with environmental auditing because of the interconnected impacts of industrial processes and hazards); site audit - an audit of a particular site to examine actual or potential environmental problems; corporate audit - an audit of the whole company and its policies, structures, procedures and practices; due diligence audit - an assessment of potential environmental and financial risks and liabilities carried out before a company merger or site acquisition or divestiture (e.g. contaminated land remediation costs); activity or operational audit - an assessment of activities that may cross company departments or units (e.g. energy or waste management) and product or life cycle audit - an analysis of environmental impacts of a product throughout all stages of its design, production, use and disposal, including its reuse and recycling (cradle to grave).

After thousands of year's stability, the chemistry of the earth's atmosphere is changing rapidly (Schlesinger, 1997). Research has revealed some of the causes of poor human and health conditions and the changes in biogeochemical cycles. The mechanics of man, like every other living thing including plants, depend largely upon air for sustainability. Therefore, greenhouse gas emission is seen as a very hazardous development for human health.

Statement of the Problem

The economic and environmental ramifications of excessive gas flaring in Nigeria's Niger Delta are quite serious because it is a waste of potential energy for domestic and industrial needs; it is also a major source of environmental degradation through the pollution of water, air, soil, plants and animals. The build-up of greenhouse gases in the atmosphere have been driven largely by growing consumption of fossil fuels in the industrialized world, together with the wanton destruction of the rain forest in developing nations. Since these greenhouse gases can stay in the atmosphere for hundreds of years, their effects are apparent. This study seeks to ascertain the implications of compliance, health and safety audit on greenhouse gas emissions and health of the people in Lagos State.

Purpose of the study

The purpose of the study is to find out the implications of compliance, health and safety audit on greenhouse gas emissions and health of the people in Lagos State. Specifically, the following specific objectives are formulated to guide the study:

1. To determine the influence of compliance audit on greenhouse gas emissions [Carbon dioxide (CO₂), Methane (CH₄), Nitrous Oxide (N₂O), Ozone (O₃), Carbon monoxide (CO), Sulfur dioxide (SO₂)] at the Olososun dump site in Lagos State.
2. To determine the influence of health and safety audit on health of the people in Lagos State.

Research Questions

The following research questions will be answered.

1. What is the influence of compliance audit on greenhouse gas emissions [Carbon dioxide (CO₂), Methane (CH₄), Nitrous Oxide (N₂O), Ozone (O₃), Carbon monoxide (CO), Sulfur dioxide (SO₂)] at the Olososun dump site in Lagos State?
2. What is the influence of health and safety audit on health of the people in Lagos State?

Hypotheses

1. There is no significant influence of compliance audit on greenhouse gas emissions [Carbon dioxide (CO₂), Methane (CH₄), Nitrous Oxide (N₂O), Ozone (O₃), Carbon monoxide (CO), Sulfur dioxide (SO₂)] at the Olososun dump site in Lagos State.
2. There is no significant influence of health and safety audit on health of the people in Lagos State.

Literature Review

Concept of Environmental Auditing

According to Grayson (1992), environmental auditing is essentially an environmental management tool for measuring the effects of certain activities on the environment against set criteria or standards. Depending on the types of standards and the focus of the audit, there are different types of environmental audit. Organisations of all kinds now recognise the importance of environmental matters and accept that their environmental performance will be scrutinised by a wide range of interested parties. Raemaekers (2003) asserts that environmental auditing is used to help improve existing human activities, with the aim of reducing the adverse effects of these activities on the environment. An environmental auditor will study an organisation's environmental effects in a systematic and documented manner and will produce an environmental audit report. There are many reasons for undertaking an environmental audit, which include issues such as environmental legislation and pressure from customers.

Auditing, in general, is a methodical examination - involving analyses, tests, and confirmations - of procedures and practices whose goal is to verify whether they comply with legal requirements, internal policies and accepted practices. The International Chamber of Commerce (ICC) produced a definition in 1989 which is along the same lines: A management tool comprising systematic, documented, periodic and objective evaluation of how well environmental organisation, management and equipment are performing with the aim of helping to safeguard the environment by facilitating management control of practices and assessing compliance with company policies, which would include regulatory requirements and standards applicable.

Many scholars assert that environmental auditing is carried out when a development is already in place, and is used to check on existing practices, assessing the environmental effects of current activities. Environmental auditing therefore provides a 'snap-shot' of looking at what is happening at that point in time in an organisation. The International Organization for Standardization (ISO) has produced a series of standards in the field of environmental auditing. These standards are basically intended to guide organisations and auditors on the general principles common to the execution of environmental audits. Environmental auditing means different things to different people. Environmental auditing is often used as a generic term covering a variety of management practices used to evaluate a company's environmental performance. Strictly, it refers to checking systems and procedures against standards or regulations, but it is often used to cover the gathering and evaluation of any data with environmental relevance.

Compliance Audit on Greenhouse Gas Emissions

The rising concentrations of greenhouse gases (GHGs) of anthropogenic origin in the atmosphere such as carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O) have increased, since the late 19th century. According to the Third Assessment Report (TAR) of the Intergovernmental Panel on Climate Change (IPCC, 2001a), because of the increase in concentration of greenhouse gases in the atmosphere (for e.g., CO₂ by 29 per cent, CH₄ by 150 per cent and N₂O by 15 per cent) in the last 100 years, the mean surface temperature has risen by 0.4–0.8°C globally. The precipitation has become spatially variable and the intensity and frequency of extreme events has increased. The sea level also has risen at an average annual rate of 1–2 mm during this period.

The continued increase in concentration of GHG in the atmosphere is likely to lead to climate change resulting in large changes in ecosystems, leading to possible catastrophic disruptions of livelihoods, economic activity, living conditions, and human health (IPCC, 2001). The United Nations Framework Convention on Climate Change (UNFCCC, 1992) requires the parties to protect the climate system in accordance with their 'common but differentiated responsibilities' and respective capabilities. It enjoins upon developed countries to take the lead role for combating climate change and the adverse effects thereof, considering their historically higher contribution to the total anthropogenic load of greenhouse gases in the atmosphere.

According to Welford and Gouldson (2004), compliance is the most important element of any mandated GHG program. Companies must develop processes and controls to measure, monitor and report GHG emissions. To avoid fines and penalties, companies also need to implement processes and controls to accurately report required information to the EPA. The EPA (2009) proposed a new rule requiring operating permits for GHG emissions under the CAA. The rule would limit GHG emissions from nearly 70% of the US's largest stationary-source GHG emitters, including power plants and refineries. Other federal agencies may be involved in regulating GHG emissions, further complicating the compliance efforts. In addition to GHG emission reports companies will have to submit to federal agencies, companies may be required to furnish additional information about GHG emissions levels in their public filings with the Securities and Exchange Commission (SEC) if the future costs associated with compliance are material. The new GHG reporting rules require written compliance procedures, adequate resources and appropriate training for key personnel involved in the data collection and reporting

processes. The rules also require internal compliance audit of the GHG data collection and reporting processes, as well as processes for periodic reporting to top management regarding compliance status and GHG reporting program results. This is especially important as the new GHG reporting rule requires companies to self-certify their emissions to the EPA.

The following three key steps are of a robust compliance program:

Measurement

The first step in the compliance process is measurement. While real-time measurement and feedback is ideal, it's not the only approach. Frequent measurement at the plant level, usually in accordance with production, serves as the foundation for the compliance system. The frequency will depend on the needs of the monitoring function. Most often, Thompson and Therivel (1991) opine that these controls are facilitated through a technology-assisted measurement solution, which will either measure GHG emissions by using equipment at the source of the emissions or estimate them based on the quantity of production.

Monitoring

Monitoring Production and emission information is typically passed to a separate monitoring function within the organization. The monitoring function can take many different forms in the energy industry. In some cases, information is provided to a plant-level environmental or compliance officer. In other cases, the monitoring function may be a centralized group in the company, such as a trading floor that actively manages and trades around the emissions position. Once emissions information is received by the monitoring function, the data must be transformed into information that can be used to manage the GHG emissions during the reporting period. Analytic tools to compare such details as actual emissions versus available credits or budgeted emissions against actual emissions are key drivers of the monitoring and management process. (CEC, 1993).

Reporting

Despite the importance of the monitoring process, reporting GHG emissions will impact companies the most (even those with an established emissions reporting processes). The reporting requirements for GHG will be distinct from other emissions reporting. There are two key components to reporting GHG emissions: regulatory reporting and public disclosure. Like other emissions, regulatory reporting will be a major part of compliance (CEC, 1993).

Influence of Health and Safety Audit on Health of the People in Lagos State

According to Ferris and Buckley (2006), Health and Safety Management is an area that is concerned with ensuring the safety, health and welfare of people engaged in work or employment. It goes further too to protect co-workers, family members, employers, customers, suppliers, nearby communities and other members of the public who are impacted by the workplace environment. Consequently, work-related accidents and diseases continue to be a serious problem in both developed and developing countries including Nigeria. The International Labour Conference (ILO) estimates that 250 million workers are involved in accidents every year and out of which 300,000 are killed. There are at least 335,000 fatal injuries caused by accidents at work. Putting accidents and diseases together, the global estimate of work-related deaths amounts to 1.1 million per year, and this according to ILO is grossly underestimated probably because of lack of comprehensive statistical data from many member states (International Labour Conference 87th Session 1999: ILO 274th session 1999).

The economic losses are enormous and, in terms of shattered families and communities, the damage is calculable. From the foregoing, it is obvious that the responsibility is on management to prevent accidents and eliminate health and safety hazards in order to minimize the suffering of the employees and by so doing minimize their own loss. In an estimate from a reliable source it was observed that in the United Kingdom alone, about 500 people are killed every year and several hundred thousand are either injured or suffer work related ill health. In an industrializing economy such as Nigeria where there are no accurate data and laws are not enforced, the figures may be higher. Newspaper reports abound in Nigeria of industrial accidents in factories mainly owned by expatriates that are poorly equipped with abysmal safety standards that will not be tolerated anywhere else. These accidents have led to deaths, amputation of limbs and permanent disabilities of the workers. Due to low levels of compliance to rules and lack of enforcement of those rules, the company barely loses anything. In many cases, compensations are not paid and because of gross unemployment, the workers cannot protest as there are countless others waiting to take their place.

Ahiuma-Young (2012) commenting on safety and health development in Nigeria revealed that the a global estimate of 2.3 million occupational fatalities occur annually while nothing less than 100 occupational fatalities and some billions of capital losses have been recorded in Nigeria between April 28, 2009 and April, 2010. However, Fajana (2012) posited that a properly-managed safety culture based on tested principles of workplace safety will produce employees who participate actively in training; these employees will be able to identify and alert one another and management to potential hazards. They develop effective control measures and feel a sense of responsibility for their safety and safety of others. Accepting safety as a responsibility demonstrates a sincere concern for each employee; which establishes the foundation for an effective safety culture he opined.

Methods

Research Design

The research designs employed for this study were descriptive and explanatory.

Study Area

The study area is Lagos State.

Study Population

The population of this study consisted of all the sample locations which are due for this test as well as environmental management scientist from the Ministry of Environment, medical professionals from the Ministry of Health and dwellers around Olososun dump site in Lagos State.

Sample and Sampling Technique

These samples were referred to as locations where green house gas emission sample were obtained to ensure that all sub-groups were adequately represented within the dump ground. A non-proportionate stratified sampling technique were used to obtain the study samples where the sample locations were randomly selected.

Sources of Data

Data for this work were obtained from both primary and secondary sources. The primary sources included field and laboratory experiments using such equipments as the sensitive gas chromatograph Mass spectrometer named MEDUSA. Secondary sources of data were obtained from the Ministries of Environment and Health in Lagos.

Method of Data Collection

The systematic random sampling technique was used to select three sampling locations within the dump site for greenhouse gas emission tests. This was to enable the researcher to determine the variation of greenhouse gases across different locations in the study area with respect to the probable source. The primary motivation for obtaining atmospheric data from top of towers was to fill existing measurement gaps in geographic location and on spatial scales. This took care of vertical distribution of gases in the air, which is affected by the weather and depends on topography of a particular area. The tests covered both dry and rainy seasons. A sensitive Gas Chromatograph Mass Spectrometer named MEDUSA was used in the measurement. In using this instrument the air sample was taken from the top of a tower at the height of 15 meters into the instrument through a system of tubes. The constituent components were chromatographically separated, then identified and quantified using an electronic capture detector (ECD). The chromatograph included a mass spectrometer, which allows further chemicals to be identified.

This fully automated sensitive gas chromatograph Mass spectrometer named MEDUSA (Material Science and Technology, 2008) delivered precise measurement data on an air sample every 80 minutes. The experiment was carried out for two months at each sampling point. The MEDUSA helped to measure tetrafluoromethane (CF₄) in the atmosphere. This substance, emitted into air as a by-product of aluminium production, is the longest lived compound ever produced by mankind, having an estimated average lifetime of 50,000 years in the atmosphere, (Material Science and Technology, 2008). In addition, combining the measurement of data with air mass trajectories helped to determine the geographical origin of the emissions.

Data Analysis and Results

Hypothesis one

The null hypothesis states that there is no significant influence of compliance audit on greenhouse gas emissions [Carbon dioxide (CO₂), Methane (CH₄), Nitrous Oxide (N₂O), Ozone (O₃), Carbon monoxide (CO), Sulfur dioxide (SO₂)] at the Olososun dump site in Lagos State. In order to test the hypothesis regression analysis was performed on the data, (see table 4.3).

TABLE 1

Regression Analysis of the influence of compliance audit on greenhouse gas emissions [Carbon dioxide (CO₂), Methane (CH₄), Nitrous Oxide (N₂O), Ozone (O₃), Carbon monoxide (CO), Sulfur dioxide (SO₂)] at the Olososun dump site in Lagos State.

Model	R	R-Square	Adjusted Square	RStd. error of the Estimate	R Square Change

1	0.06	0.00	-0.04	17.27	0.00
1	0.04	0.00	-0.04	1.58	0.00
1	0.01	0.00	-0.05	1.25	0.00
1	0.10	0.01	-0.04	0.39	0.01
1	0.16	0.03	-0.02	0.74	0.03
1	0.15	0.02	-0.02	1.83	0.02

***Significant at 0.05 level; df= 22; N= 24; critical R-value = 0.344**

The table shows that the calculated R-value of [Carbon dioxide (CO₂), Methane (CH₄), Nitrous Oxide (N₂O), Ozone (O₃), Carbon monoxide (CO), Sulfur dioxide (SO₂)] as 0.06, 0.04, 0.01, 0.10, 0.16 and 0.15 respectively all less than the critical R-value of 0.344 at 0.5 alpha level with 22 degree of freedom. The R-Square values of (0.00, 0.00, 0.00, 0.01, 0.03, 0.02) predicts (0%, 0%, 0%, 1%, 3% & 2%) of the influence of compliance audit on greenhouse gas emissions [Carbon dioxide (CO₂), Methane (CH₄), Nitrous Oxide (N₂O), Ozone (O₃), Carbon monoxide (CO), Sulfur dioxide (SO₂)] at the Olososun dump site in Lagos State. The result therefore means that there is no significant influence of compliance audit on greenhouse gas emissions [Carbon dioxide (CO₂), Methane (CH₄), Nitrous Oxide (N₂O), Ozone (O₃), Carbon monoxide (CO), Sulfur dioxide (SO₂)] at the Olososun dump site in Lagos State

Hypothesis Two

The null hypothesis states that there is no significant influence of health and safety audit on health of the people in Lagos State. In order to test the hypothesis regression analysis was performed on the data, (see table 2).

TABLE 2

Regression Analysis of the influence of health and safety audit on health of the people in Lagos State.

Model	R	R-Square	Adjusted Square	RStd. error of the Estimate	R Square Change
1	0.92	0.84	0.84	0.53	0.84

***Significant at 0.05 level; df= 22; N= 24; critical R-value = 0.344**

The table shows that the calculated R-value 0.92 was greater than the critical R-value of 0.344 at 0.5 alpha level with 22 degree of freedom. The R-Square value of 0.84 predicts 84% of the influence of health and safety audit on health of the people in Lagos State. The result therefore means that there is significant influence of health and safety audit on health of the people in Lagos State.

Discussion of the Findings

The results of the data analyses in table 1 were not significant due to the fact that the obtained R-values which were (0.06, 0.04, 0.01, 0.10, 0.16 and 0.15) were all less than the critical R-value (0.344) at 0.05 level with 22 degree of freedom. The result implies that there is

no significant influence of compliance audit on greenhouse gas emissions [Carbon dioxide (CO₂), Methane (CH₄), Nitrous Oxide (N₂O), Ozone (O₃), Carbon monoxide (CO), Sulfur dioxide (SO₂)] at the Olososun dump site in Lagos State. The result therefore was in disagreement with the research findings of Welford and Gouldson (2004) who asserted that compliance is the most important element of any mandated GHG program. Companies must develop processes and controls to measure, monitor and report GHG emissions. The non-significance of the result caused the null hypotheses to be retained while the alternative one was rejected.

The result of the data analysis in table 2 was significant due to the fact that the obtained R-value (0.92) was greater than the critical R-value (0.344) at 0.05 level with 22 degree of freedom. The result implies that there is significant influence of health and safety audit on health of the people in Lagos State. The result therefore was in agreement with the research findings of Ferris and Buckley (2006) who highlighted that Health and Safety Management is an area that is concerned with ensuring the safety, health and welfare of people engaged in work or employment. The significance of the result caused the null hypotheses to be rejected while the alternative one was accepted.

Conclusion

Based on the findings of the research work, the following conclusions are deemed necessary: There is no significant influence of compliance audit on greenhouse gas emissions [Carbon dioxide (CO₂), Methane (CH₄), Nitrous Oxide (N₂O), Ozone (O₃), Carbon monoxide (CO), Sulfur dioxide (SO₂)] at the Olososun dump site in Lagos State. There is significant influence of health and safety audit on health of the people in Lagos State.

Recommendations

Based on the findings of the study, the following recommendations are deemed necessary:

1. Auditors can increase impact by choosing topics that legislators and the public care about, such as health, the economy and jobs, the local environment and community, or the nation as a whole.
2. Government should be careful in their decision-making processes, management systems, and internal controls as they above objectives are important for achieving environmental results.

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