



## **Environmental Audit Risk Management: A Tool For Sustainable Industrial Development In Nigeria**

<sup>1</sup>Egbo, Walamam Mansi & <sup>2</sup>Realman, Evans Obele

<sup>1</sup>Department of Science Laboratory Technology, Bayelsa State Polytechnic Aleibiri, P.M.B 168,  
Ekeremor, Bayelsa State, Nigeria

<sup>2</sup>Department of Mathematics, Jasper Adaka Boro College of Education, Sagbama , Bayelsa State,  
Nigeria

\*Corresponding author: Dr. Egbo Walamam Mansi; Phone No: 08066677173; E-mail: [egbomansi@yahoo.com](mailto:egbomansi@yahoo.com)

### **ABSTRACT**

This paper seeks to highlight and emphasize the recognition and adoption of environmental audit as a proactive environmental risk management tool for sustainable industrial development in Nigeria. This will help to checkmate the menace of industrial accidents in Nigeria factories. Some cases of reported industrial accidents in Nigeria factories and causal factors from 1987 – 1996, including food, beverage and tobacco, Coal and petroleum, Basic metallic, fabricated metal industry, Electric engineering, wood and wood product, rubber products manufacturing, publishing and printing, foot wear products, pulp and pulp products, chemical and pharmaceutical industries have been critically reviewed. Results indicate that many of the accidents were caused by unsafe conditions, unsafe practices and management negligence. Since environmental audit is a systematic, documented, periodic and objective evaluation of how well an organization environmental management and equipment are performing with the aim of correcting identified deficiencies and reduce risk, majority of the industrial accidents would have been averted if there was due diligence and environmental and safety audit was regularly and effectively conducted. It is recommended that periodic environmental and safety audit should be made mandatory for all manufacturing industries and chemical storage facilities so as to proactively management the menace of industrial accidents.

**Keyword:** Environmental audit, accidents, risk management, sustainable industrial development

### **INTRODUCTION**

The importance of the environment to humans and other live forms cannot be over stressed. Brundtland defined the environment as where we live (Robert, *et al*, 2005). It is important to us because the environment provides the necessary conditions and the natural resources upon which living things depend on for their continuous existence on earth. The environment also provides platform for all forms of human development. However, anthropogenic activities such as industrial development and operations, certain natural phenomena exert negative consequences on the environment.

---

Being a paper presented at the 9th International Conference of the Faculty of Social Sciences, Ignatius Ajuru University of Education, Rumuolumeni, Rivers State Nigeria

Industrial activities impact on the environment in a number of ways. For instance, industrial production depends on raw materials which are usually exploited from the environmental natural resources. In the course of the exploitation and refinement, wastes are often times generated and in turn disposed or discharge into the environment which consequently results to pollution of ground water through leaching, pollution of surface water through direct disposal into water bodies or through surface run off into water bodies such as lakes, rivers, creeks, ponds, wetlands etc.

Apart from natural resources exploitation and refinement, in the main stream of industrial processes, by products and waste are usually generated which usually further negatively impact on the environment on their own or combined with waste already disposed into the environment during the raw material production and therefore make more complex the environmental impact or consequences. Industrial emissions and effluents discharges are other aspect of industrial activities or operations that impact on the environment negatively. Industrial emission causes atmospheric pollution which affects human health, plants, animals and facilities.

Industrialization promotes socioeconomic development of any given nation and indeed the world. It also creates employment and raises the standard of living of people. However, history showed that industrial accidents have happened at various times with serious environmental impacts. What is accident any way, The Institute of Safety Professionals of Nigeria (ISPON, 2019) defined accident as unplanned and unintended occurrence in the course of an activity or operation in the work place, which causes or could cause personal injury, property damage, or interference with production or other business activity. Most industrial accidents have occurred many times as a result of failures to follow operational procedures, infrastructural failures, unsafe conditions and unsafe acts (ISPON, 2019). Many of these accidents could have been averted if proper due diligence were done by the operators.

Some accidents were due to transportation of hazardous materials, accidents due to storage facilities or accidents due to production facilities failure while some other accidents are due to human failures to follow safety procedures. Many industrial accidents were caused by either human error, substandard conditions of industrial facility, substandard acts (Mohan, 2013). Many industrial accidents resulted to loss of lives, permanent partial disabilities of the victims, destruction of industrial machines and catastrophic environmental consequences. Mohan (2013) also reported that some negative environmental impacts of industrial accidents may include impact on the health of the biota, impact on the eco-system, impact on the terrestrial system and impact on the aquatic system.

In order to protect the environment from man's industrial and technological activities and to maintain its quality as well as protect the health of workers, several environmental pollution control and management tools have been developed. One of such tool is the environmental audit. Environmental audit is a major aspect of Environmental Management System (EMS). Environmental Management System (EMS) is a management tool that helps organizations to identify the environmental impacts resulting from their activities, processes, products and services and to improve their environmental performance (Australian Government (2004).

Industries can benefit greatly from regular and efficient environmental audit of their processes, material flow, technologies and procedures to identify which areas of their activities problem can arise particularly with respect to pollution, human health and safety. Environmental audit is a veritable tool to achieve sustainable industrial development. The focus of this paper is to highlight and emphasize the recognition and adoption of environmental audit as a proactive environmental risk management tool for sustainable industrial development.

### **Concept of Sustainable Development**

The concept of sustainable development is anchored on the principle that development must not be impeded but the environment must not be degraded. According the South Africa National Strategy for Sustainable Development (NSSD, 2011), the concept of sustainable development recognized the interdependency between economic growth, social equity and environmental integrity. This is being adopted by nations of the world as a conceptual framework for development.

The impact of human development on the environment was recognized as a global problem since the 1972 Stockholm Conference on the Human Environment organized by the United Nations (UN). In that conference, the conflicts between the environment and development were acknowledged. This acknowledgement was then followed ten years after by another world conference in 1982 at Montego Bay Jamaica, where the General assembly of the United Nations Initiated the world commission on Environment and development. This Commission was chaired by then Prime Minister of Norway Gro Harlem Brundtland, hence it was usually called the Brundtland commission. Brundtland argued that;

“The environment does not exist as a sphere separate from human actions, ambitions, and needs and attempts to defend it in isolation from human concerns have given the very word “environment” a connotation of naivety in some political circles. The word “development” has also been narrowed by some into a very limited focus, along the lines of “what poor nations should do to become richer,” and thus again is automatically dismissed by many in the international arena as being a concern of specialists, of those involved in questions of “development assistance.” But the “environment” is where we live; and “development” is what we all do in attempting to improve our lot within that abode. The two are inseparable.” Anchoring on this argument, the Brundtland Commission then defined sustainable development as the “ability to make development sustainable—to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs” (Robert, *et al*, 2005).

### **Essential Elements of Environmental Risk Management**

According to USEPA (2017) environmental risk management is an environmental management approach that seeks to determine what environmental risks exist and then determine how to manage those risks to protect human health and the environment. Major environmental risk all over the world is industrial accident/pollution. The principle of accident prevention involves minimization or elimination of any possibility of hazards. This implies that accident prevention is a proactive and not reactive process. That means dangerous or harmful situation that can arise in a given sets of circumstances in the industrial or work place setting must be identified and measures taken to eliminate or minimize the factors that can give rise to such dangerous or harmful incidence.

Gomley., Polland and Rooks (2011) identified essential elements of environmental risk assessment and management to include, identification of the hazard at the beginning of the assessment, Estimation of the potential risk of the hazard being analyzed, Consequence analysis and risk evaluation, determination of possible options for effective elimination or reduction of the risk. Deciding which of the options is better or will be more effective in preventing the identified risk.

After decision on the management of the risk is taken, the decision must be implemented and monitored. When decision on the option to mitigate identified risk is taken, strategies are developed and implemented in order to achieve the desired goal of the decision. Humans get complacent after following a routine for a while and therefore begin to break safety protocols and engage in unsafe practices. This is corroborated by the revelation that “analysis of major chemical accidents has exhibited deficiencies like laxity toward safety measures, non-compliance to Techno-legal systems; lesser public consultation (Bhardwaji *et al*, 2007). This is an affirmation that periodic audit of industrial processes, activities, equipment and staff competence is necessary.

Hazard identification entails determination of what can go wrong by identifying a set of circumstances. Risk estimation involves prediction of the likelihood that a set of circumstances will arise. Consequence analysis is the determination of the significance or severity of the outcome of hazardous event. Risk assessment is the integration of risk estimation and consequence analysis. Risk mitigation targets at how risk can be eliminated or reduced.

### **Environmental Audit as a Proactive Risk Management Tool**

Sound environmental management is equated with good industrial management because it is no longer legitimate for management of industries to disregard the environment and staff safety and

indiscriminately exploit them for profit. With the increasing concern for the environment and workers safety, industries are coming under strict obligations to take stock of the environment in which they operate and make sure their activities conform to standard and regulations stipulated by government and regulatory authorities with regards to safety and environment. Industries can benefit greatly from critical self-examination (audit) of their processes, material flow, technologies and procedures to identify which areas of their activities problem can arise particularly with respect to pollution, human health and safety. Environmental audit is a veritable tool for self-examination in order to achieve sustainable industrial development. The scope of environmental audit encompasses:

- Air pollution control.
- Water pollution control
- Waste management.
- Employee safety.
- Industrial hygiene
- Loss prevention and Emergency response.
- Training policies and need.
- Structural integrity of industrial facilities.

Environmental audit should not be undertaken just to facilitate compliance to laws and regulations, but should be seen as a strategic proactive tool for industrial risk management. The greatest industrial advantage of regular environmental audit is that, it enables industry operators to have awareness of their staff competence, processes, procedures, material flow, identify compliance problems and areas of risk, strength and weakness and take steps to correct deficiencies and encouraging continual performance improvement. During environmental audit, use and flow of resources is evaluated and documented, potential hazards and risks are identified, and corrective measures are recommended and followed up (Agarwal, 2005).

Environmental audit has three international standards and guideline. These are ISO14010, 14011 and 14012. These standards require that industries or corporations should establish and maintain programs and procedures for periodic environmental management system audit. Environmental Management System (EMS) is a well structure environmental management tool that addresses all environmental aspect of an organization including compliance to relevant environmental laws and regulation, hence environmental management systems audit is generic environmental audit process which scope encompasses, compliance, waste management, air pollution, water pollution, industrial hygiene, employee safety, Loss prevention/emergency preparedness, materials, work practice and personnel competence audits. It is an integrated approach to environmental audit of organization operations and environmental performance.

#### **Key objectives of environmental audit**

The key objectives of environmental audit are to:

- i. Identify actual and potential risks and liabilities of an industrial set up with view to eliminating or reducing industrial accident and pollution.
- ii. Determine the material flow and the performance of various processes and equipment.
- iii. Determine the characteristics and quantity of waste and best management option.
- iv. Identify possibilities of waste elimination or minimization, recovery and recycling.
- v. Determine compliance with regulatory and legislative requirements.
- vi. Determine the impact of the industries operation on the surrounding environment as a result of waste disposal, emissions and solid waste from the industry processes.
- vii. Determine overall environmental performance of an organization.
- viii. Determine competence of staff and the understanding of their roles and responsibilities in preventing accident and pollution.

#### **Benefits of environmental audit**

- I. Help to safeguard the environment by reducing risk..
- II. Provide opportunity for process monitoring.

- III. Provide opportunity for management to assess its current environment, health and safety performance.
- IV. Help to enhance prevention of losses.
- V. It increases employee’s awareness of environmental policies and their responsibilities.
- VI. Assist in the assessment of clean and green technologies.
- VII. Help in the identification of potential cost saving strategies including waste minimization options
- VIII. Help in the evaluation of existing training program and training needs of staff
- IX. Help to boost board members and investors’ confidence.
- X. It facilitates compliance with legislative and regulatory requirements.

**Some reported Industrial Accidents in Nigeria factories and fatality rates**

Accident is commonly viewed as unplanned events with injuries and damages as the usual outcome. With this view in mind, many people conceived the concept of accident to mean something unexpected and unplanned and therefore nothing could be done to help or avert the occurrence. However, a realistic examination of accidents data show that only few events can really be termed accidents while many of this event tagged accident were not really unforeseen because most of them are not chance events but rather reflection of inefficiency in the system and lack of due diligence. Human errors are frequently the cause of accidents that is why in the field of professional safety, there is a cliché that “Accidents do not just happen but they are caused “. The theories of accidents postulate that, there are three reasons why accidents happen. (1) Substandard working condition (unsafe condition. (2) Substandard working practice (unsafe practice) and (3) Human factors (Agarwal, 2005). It therefore becomes important that each of these factors is reviewed and conditions created where all the undesirable factors are eliminated and the possibility of accidents eliminated in turn. Regular examination of facilities and working practices and procedures (environmental and safety audit) will help to ensure compliance to environmental regulations and safety guidelines. For instance, there are opinions in some quarters that industrial accidents such as the Bhopal gas leak incident of 1984 and the 1986 Chernobyl nuclear plant disaster are the outcome of willful action of man (Agarwal, 2005). Some reported industrial accidents in Nigeria factories and causal factors from 1987 – 1996 are shown in Table 1 and 2

**Table 1: Industrial accidents and death trends in Nigeria factories (1987 – 1996)**

S/N	Type of industry	Total number of accidents	No of deaths	Fatality rate (%)
1	Food, beverage and Tobacco	245	7	2.86
2	Coal and Petroleum	48	8	16.67
3	Basic metallic industry	514	9	1.76
4	Fabricated metallic production	47	1	0.13
5	Electrical engineering	78	2	2.56
6	Manufacturing and assembly transport	139	4	2.88
7	Other metallic industry	45	2	4.44
8	Clothing and footwear	13	-	-
9	Manufacture of rubber products	45	-	-
10	Wood and wood products	51	3	5.88
11	Chemical and Pharmaceuticals	587	11	1.87
12	Textile manufacturing	593	7	1.18
13	Pulp and pulp products	68	-	-
14	Publishing and printing	-	-	-
15	Manufacturing non metallic	86	5	5.81
16	Other manufacturing industry	139	4	2.88
17	Gas, electricity and water	46	1	2.17
	<b>Total</b>	<b>3183</b>	<b>71</b>	<b>2.23</b>

Source: Afamdi, (2001)

**Table 2: Industrial accidents/ fatality trend in Nigeria factories and causal factors (1987 – 1996)**

S/N	Causes	Total number of injuries	No of deaths	Case Fatality rate (%)
1	Prime mover	45	-	-
2	Wood working machinery	69	1	1.45
3	Transmission machinery	143	3	2.45
4	Lifting machinery	92	-	-
5	Other machinery driven by power	670	12	1.79
6	Transport vehicles	90	8	8.89
7	Electricity	54	7	13
8	Explosion	137	10	7.30
9	Fi3r2.50e	120	3	2.50
10	Hot or corrosive substance	242	2	0.83
11	Lifting machinery not moved by power	29	-	-
12	Other machinery not moved by power	66	-	-
13	Hand tools	154	-	-
14	Struck by falling objects	316	6	1.90
15	Person falling	294	9	3.06
16	Stepping on or struck by objects	208	1	0.48
17	Handling goods	295	1	0.34
18	Gassing , poisoning	30	2	6.67
19	Others	133	6	4.51
	<b>Total</b>	<b>3183</b>	<b>71</b>	<b>2.23</b>

Source: Afamdi (2001)

### CONCLUSION

Risk is inherent in all human endeavors and is much more in industrial setting because of the multiplicity and the complexity of the processes. However the risk in the industries can be greatly minimized to a barest minimum by deliberate conscious effort through Environmental audit risk management which when regularly and efficiently undertaken will help to eliminate or reduce industrial accidents.

### RECOMMENDATION

This study has identified that many industrial accidents were caused by management negligence and cover up of substandard conditions of industrial facilities. It is therefore recommended as follows.

1. Nigeria should adopt environmental and safety audit and make it mandatory for all industries and chemical storage facilities to periodically audit their facilities, personnel and activities.
2. Enact laws making environmental and safety audit in industries mandatory.
3. Report of an independent audit of industrial and chemical storage facilities should be submitted to a regulatory authority for evaluation and verification

### REFERENCES

- Afamdi O. Ezenwa (2001). A study of fatal injuries in Nigerian factories. *Occup. Med.* 51(8). pp. 485-489
- Agawarl, S.K (2005). *Environmental management*. A.P.H. publishing corporation, New Delhi 110002. . Pp. 135-165
- Australian Government (2004). Environmental management system tool. guide Note of the department of the environment, water, heritage and the arts. Retrieved from <http://www.ncsi.com.au/standards.html>.

- CBCnews (2014). British Columbia 'Burns lake sawmill explosion and fire called preventable. Retrieved from <http://www.cbc.ca>. British Columbia
- Gomley, A., Polland, S, Rocks, S, (2011). Green leave. guideline for environmental risk assessment and management, for Cranfield University. Retrieved from "[https://en.wikipedia.org/w/index.php?title=Ajka alumina plant accident&oldid=91587204](https://en.wikipedia.org/w/index.php?title=Ajka_alumina_plant_accident&oldid=91587204)" Categories
- ISPON (2019). General health, safety and environment, training manual. (2019 Edition). Firstborn3trinity link publisher. Port Harcourt. Pp, 4-50
- Jana Ray, Bhardwaji, Raman, Chawfa and Rakesh Kamar Sharma (2007). Chemical disasters management: current status and perspective. *Journal of Scientific and industrial research*. Vol66. Pp 110-119.
- Mohan Roa, P.V.J (2013). Industrial accidents impact on environment. *Global Journal of engineering design and technology*. Vol. 2(4): 41-42
- NDTV Beeps (2016). 200 People fall sick after ammonia leak in Bangladesh. Daily newsletter. Retrieved from <http://www.ndtv.com>. world.
- Robert W. Kate., Thomas M. Parris, and Anthony A. Leiserowitz, (2005). What is sustainable development? goals, indicators, values, and practice. *International journal of environment: science and policy for sustainable development*. Vol. 47(3): 8–21.
- USEPA (2017). Environmental risk management. USEPA Web archive. Retrieved from [www.epa.gov](http://www.epa.gov),v