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HAZARDS IDENTIFICATION AND RISK ASSESSMENT IN FOOD PROCESS INDUSTRIES

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ABSTRACT

In this study, different hazards which personnel are exposed to were identified. Two plants were used as case study. Plant A is Seven up Bottling Company located in Benin City, Nigeria and Plant B is Nigeria Bottling Company (Coca-Cola) also located in Benin City Nigeria. The conditions of operations of personnel were investigated in the two plants in order to identify the different hazards personnel were exposed to. The hazard identification carried out revealed that Plant B personnel were exposed to more hazards than Plant A. Risk analysis were also performed on the Plants and it was discovered that plant B has higher risk than plant B. Different precautionary measures were suggested in order to reduce the hazards in both plants.

Keywords: Hazards, Identification, Process, Industries, Risks

INTRODUCTION

Hazard identification involves a critical sequence of information gathering and the application of a decision-making process. [4] These assist in discovering what could possibly cause a major accident (hazard identification), how likely it is that a major accident would occur and the potential consequences (risk assessment) and what options there are for preventing and mitigating a major accident (control measures). [1] These activities should also assist in improving operations and productivity and reduce the occurrence of incidents and near misses. The first step to emergency preparedness and maintaining a safe workplace is defining and analysing hazards. Although all hazards should be addressed, resource limitations usually do not allow this to happen at one time [7]

The last two decades marked the emergence, rapid proliferation, growth and development of food processing industries (both foreign and indigenous) in Nigeria [2]. This is due to increasing demand for processed food, particularly in urban areas.
In the food industry, a hazard is a biological, chemical, allergenic or physical substance that has the potential to harm [1]. It may also be a condition (e.g. high humidity) that could cause harm. Not all hazards are as serious, or as immediate as a threat, as others. Some situation can be more 'hazardous' depending on the levels, sizes, quantities or dozes of unwanted substance or conditions.

When it comes to food or food processing, just how hazardous a substance or condition is, may vary greatly [5]. The level of danger may depend not only on the type of hazard, but also on who might consume a food product. These usually is a threshold level below or above which the presence of a hazard is considered tolerance, or acceptable. For any industry to be successful, it has become essential to identify the Hazards, to assess the associated risks and to bring the risks to tolerable level. [8]

MATERIALS AND METHODS

Description of the study areas: Two food process industries were selected for the purpose of this study. Industry A is located on Benin-Lagos Express way,Oluku, Benin City, Nigeria while industry B is located on the Sapele Road, Benin City, Nigeria .

Participants: The participants consisted of forty seven employees. Twenty seven were drawn from Seven–up Bottling Company, and twenty from Nigeria Bottling Company(CocaCola) Sapele Road, Benin City, Nigeria. The sampling technique was stratified random sampling, which specified that the sample be first classified along some specific criteria. Thus employees were randomly selected from each department using simple random sampling technique.

Design of the study: The study design was based on the investigative survey research approach (ISRA) [7]. Site visits were made to the selected food processing factories. The tasks accomplished during such visits included inspection of processing operations; taking relevant measurements; collection of pasts and current reports on accidents which occur as a result of lack of proper risk and hazard management; interviewing relevant staff of the industries and residents of the industrial areas and administering questionnaires to them. Two types of data were sought in each of the industrial projects visited. These are qualitative and quantitative in nature and were based on observations, measurements, computations, existing records, and information from structured questionnaires, expert opinions, and publications.

Description of the questionnaire: The questionnaires for this study contain the necessary information on likelihood of hazards and probable risk that the workers may be exposed to. It seeks information on potential industrial and environmental hazard. It also entails the isolation of the elements and sub elements of the environment upon which the activities of the food processing industries may have severe or significant impact.

Method of analysis

Oregon Emergency Management (OEM) Hazard Analysis Methodology: This hazard analysis methodology was first developed by Federal Emergency Management Agency in 1983, and gradually refined by Oregon Emergency Management (OEM) over the years. During 1984, the predecessor agency to OEM (Emergency Management Division) conducted workshops around the State of Oregon that resulted in all of Oregon's 36 counties producing an analysis using this methodology. Since then, several cities have also conducted an analysis using this method.

The methodology produces scores that range from 24 (lowest possible) to 240 (highest possible), one order of magnitude from lowest to highest. Vulnerability and probability are the two key components of the methodology. Vulnerability examines both typical and maximum credible events, and probability endeavors to reflect how physical changes in the jurisdiction and scientific research modify the historical record for each hazard. Vulnerability accounts for approximately 60% of the total score, and probability approximately 40%. This method provides the jurisdiction with a sense of hazard priorities, or relative risk. It doesn't predict the occurrence of a particular hazard, but it does "quantify" the risk of one hazard compared with another. By doing this analysis, planning can first be focused where the risk is greatest. Among other things, this hazard analysis can:

- help establish priorities for planning, capability development, and hazard mitigation;
- serve as a tool in the identification of hazard mitigation measures;
- be one tool in conducting a hazard-based needs analysis;
- Serve to educate the public and public officials about hazards and vulnerabilities; and
- help communities make objective judgments about acceptable risk.

RESULTS

Table 1: Analysis of questionnaires obtained from the two plants

S/N	Derived Variables	True	False	Difference	Ranks	Remarks
1	Poor hazard monitoring	37	10	27	13	Significant
2	Toxicity(Chemica1spills)	35	12	23	16	Significant
3	Absence of personal protective equipment	46	1	47	6.2	Significant
4	Electrical hazards	36	11	25	12.2	Significant
5	Fire hazards	32	15	17	15	Significant
6	Machinery hazards	36	11	24	14	Significant
7	Systemic Weaknesses	38	9	29	11.9	Significant
8	Gas cylinder hazards	10	37	-27	11	Non significant
9	Inadequate safety in Industrial Design	26	21	4	20	Significant
10	Lifting equipment hazard	33	14	29	12	Significant
11	Manual operation and handling hazards	30	17	13	13	Significant
12	Vibration hazards	23	24	1	22	Significant
13	Work equipment hazards	31	16	15	9	Significant

Table 2:Accident free period for Plant A

Accident free period	Accident free man
26.10.1997-31.05.2000	940
02.06.2000-08.06.2002	730
01.09.2002-31.12.2002	120
01.01.2003-22.08.2004	600
28.08.2004-15.02.2006	910

Table 3:Accident free period for PlantB

Accident free period for	Accident free man
26.10.1997-31.05.2000	921
02.06.2000-08.06.2002	722
01.09.2002-31.12.2002	133
01.01.2003-22.08.2004	560
28.08.2004-15.02.2006	870

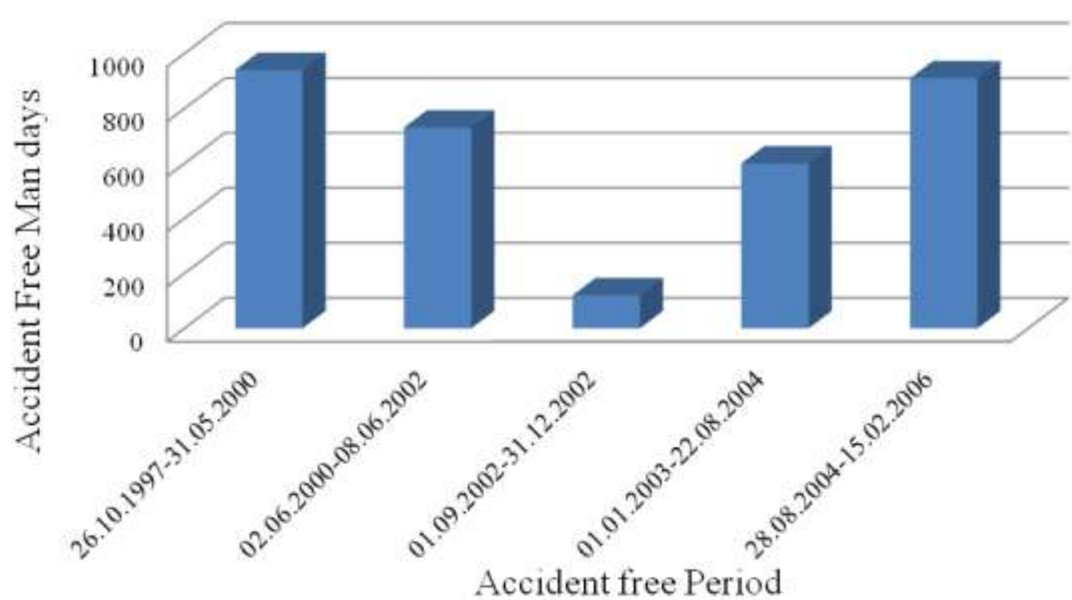

Figure 1: Accident free period for Plant A

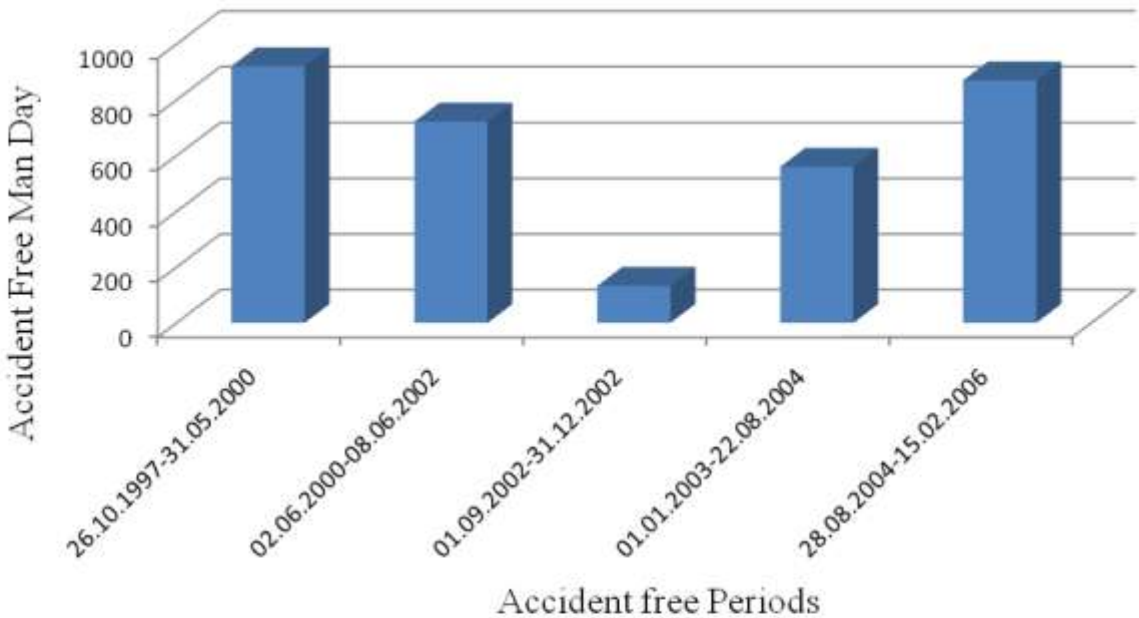

Figure 2: Accident free period for Plant B

TABLE 3: RISK ANALYSIS FOR PLANT A

S/N	HAZARD	PERSON RESPONSIBLE OR AFFECTED	RISK ASSESSMENT	RATING
1	Manual Handling of heavy cartons-there is no device available to assist Warehouse men and driver in lowering heavy cartons from the back of the lorries, some of which do not have tail lift.	Delivery Personnel	HIGH	10
2	Working in the production plant without helmet	Plant personnel	HIGH	10
3	Manual inspection of bottles in the conveyors	Plant personnel	HIGH	10
4	Working in the Plant without noise shield	Plant personnel	MEDIUM	5
5	Some of the floor were wets as a results of overflow of water from washing of the used bottles	Plant personnel	HIGH	10

TABLE 4: RISK ANALYSIS FOR PLANT B

	HAZARD	PERSON RESPONSIBLE OR AFFECTED	RISK ASSESEMENT	RATING
1	Manual Handling of heavy cartons-the available fork lift were not enough which makes Warehouse men and driver in lowering heavy cartons from the back of the lorries.	Delivery personnel	HIGH	10
2	Helmet were available but not enough and personnel do no often use then whenever carrying out their operations	Plant personnel	MEDIUM	5
3	Manual Handling/Transporting of raw material from the warehouse to the plant	Delivering Personnel	MEDIUM	5
4	Manual loading of products for delievery to consumers	Delivering Personnel	HIGH	10
5	Wet floor as result water spillage from the bottle washer	Plant Personnel	HIGH	10

DISCUSSION

Research results showed that toxicity is instrumental to employee death and disabilities in process industries [Table 2 and 3]. Toxicity refers to substances hazardous to health such as chemical, carcinogens and biological agent. It further relates to the production, storage, distribution and use of hazardous substances. As explained by Stephenson (1988)[6] toxic chemicals affect the body if it is inhaled or if it comes in contact with the eyes, skin, nose or throat. For example, inhalation of high concentration of hydrogen sulphide vapour shall cause loss of consciousness, headache, dizziness and loss of the sense of smell.

Gas cylinder hazards have been identified as an agent of corporate accidents and disabilities**.** This is because a cylinder may burst due to abnormal pressure rise and ignition of an explosive gas mixture inside the cylinder. In the event of a blow-off or leakage of flammable gas, the escaping gas may ignite immediately leading to explosion and intense tongue of fire causing secondary accidents. Secondly, in the event of leakage of toxic gas such as chlorine or sulphur dioxide, both workers and the general population in the vicinity are affected, and vegetation over a wide area is usually damaged.

The use of electrical system in the workplace introduces many hazards, which if not properly controlled can often have serious consequences. As revealed in this study, electrical hazards have the potential to kill and depreciate employees in the workplace by means of electrocution of persons working on electrical systems or using an electric appliance; and electrical fires or explosions which can result to electric burns, electric shock and associated injuries. These hazards happen in workplace due to sparks emitted from electrical equipment, ignition of flammable substance etc.

In spite of the advantages of lifting equipments such as loading and stacking of both raw materials and finished products in company warehouse, this study indicate that many workers have been crushed to death and a greater majority disabled as a result of the problems associated with lifting equipments. Experts such as Couch and Krollsmith (1995)[3] observed that contact with persons, accident to operators, falling goods, overturning of equipment and failure of lifting equipments are the major problems associated with lifting equipments. These problems according to Couch and Kroll-smith result from incorrect installation, deterioration and inadequate maintenance. From the point of view of this study, these problems frequently manifest themselves in industrial settings in Nigeria and therefore impel corporate accidents and disabilities in process industries.

The result has further revealed that fire is one of the most serious hazards in an industrial system. Its potential effects in terms of loss of life and damage to equipments and general infrastructure as observed in this study are enormous. This result therefore implies that the phenomena that produces fires such as: incandescent materials, radiation, explosions of vapour or gases, explosion of dust or atomized liquid, sparks, spontaneous combustion and chemical reaction are widely existing causing fire explosion and resulting to employee massacre, disabilities and economic loss.

Despite the fact that many types of work equipments, particularly complex machinery, have made significant contribution to production and efficiency, this study found that the hazardous nature of much of these equipments have caused numerous injuries and deaths. This result is symptomatic of the fact that the risks associated with work equipment such as: poor maintenance, archaic work equipment, rolling-over of mobile work equipment, overturning of fork-lift truck, work equipment failure and poor reliability of work equipment - frequently result to occupational accidents observed to lead to serious injuries or fatalities.
Machinery hazards include: crushing hazards, shear hazards, drawing-in hazards, entanglement hazards, impact hazards, friction and abrasion hazards, cutting hazards, and stabling and puncture by flying objects. As observed in this study, these hazards have the potentials to cause serious injuries to employee disabilities and death. The implication of this finding is that an employee coming into direct contact with the dangerous machine components shall suffer from a variety of injuries such as burns from hot machines, amputation from, machines with sharp blades, cut and abrasions from machines with abrasive surfaces and traps from conveyors systems, etc.

Similarly, the result showed that inadequate safety in industrial designs has the potential to cause fatalities. Safety in design is most effectively used when building new facilities or modifying or upgrading existing facilities. Safety in design emphasizes in-built safety protectors in factory building and including long-linked and intensive technologies used in the manufacturing process. This result therefore implies that inadequate safety in industrial designs predisposes employees to serious and multiple occupational hazards which directly occasion momentous injuries and fatalities.

Another important element of the result is that systemic weaknesses have been observed as one of the causative factors in corporate accidents and disabilities. Systemic weaknesses comprise factors such as inadequate training, production pressures, excessively demanding tasks, high-risk environments and long work hours. These are, in large measure, not matters directly controlled by the worker. The implication of this development therefore holds that poor management commitment to safety contributes to accidents.

In an ideal industrial setting, Personal Protective Equipment (PPE) are intended to be worn or held by a person at work and which gives protection against health and safety. They include protective clothing such as aprons, safety footwear, safety helmets, high visibility clothing, gloves, clothes needed for adverse weather conditions, eye and ear protector, safety harnesses etc. Unfortunately, this study has revealed that personal protective equipments are seriously lacking in food process industries. Consequently, employees are exposed to risks to their health and safety such as: falls from a height, stabs and cuts, mechanical impact, crushing, heat and fire, harmful bacteria, vibration, electric shock, radiation, noise, dust, fumes, gases and vapours. On the bases of this result, it is hereby observed that absence of personal protective equipment has the potential to cause accident and disabilities.

The accident free days for Plant A are shown in Figure 1, while that of Plant B is shown in Figure 2. The results revealed that Plant B has less accident free days than Plant. This is as a result of more hazards that were identified in Plant B compared to Plant A. Finally, the result showed that poor hazards monitoring practice in process industries results to injury, ill health and damage to or loss of plant and materials. Hazards monitoring typically advocates for a recurrent process of observation, recording and analysis of products, processes, phenomena, or person for hazardous events or consequences, the location, etiology or treatment which is in doubt. This result implies that in situations where organizations fail to lay more emphasis on hazard detection, prevention and regular "health checks" (audit) of potentially dangerous situations or development in organizations, enormous human and economic losses invariably result. On the basis of this finding, it is therefore established that inadequate hazard monitoring in chemical industries, apart from effecting employee injuries and causing disabilities, absent of hazard monitoring create a chance event involving damage to property, equipment, productivity, the environment, interrupts business and reduce profits.

CONCLUSION

Corporate accidents and disabilities among workers in food process industries arise from occupational hazards within the organizational environment. These hazards are the byeproducts of the industrial process and are involved in obliterative mission to decimate and incapacitate the human resources in organizations. Consequently, this study sought after the causative stimuli variables that are responsible for premature employee demise and handicap. On the basis of clear scientific findings they include: poor risk management, poor hazards monitoring, toxicity, absence of personal protective equipments, electrical hazards, gas cylinder hazards, fire hazards, vibration hazards, machinery hazards, poor safety in design hazards, systemic weaknesses, lifting equipment and work equipment hazards.

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