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The Occupational Health and Safety in the Construction Industry: Causes of Accidents and Preventions

Yakubu Onuvava Mathew
Department Of Building Technology ,
Kogi State Polytechnic,
P.M.B 1101 Lokoja

Abstract - **In the built-environment, the Occupational Health and Safety (OHS) in the Construction industry are of grave concern around the world due to its complex nature in its operations. The Construction industry is a key factor in the overall economic growth of the country through its contributions to the GDP growth annually and provision of employment to the nation at large. Nigeria's vision 2020 intent is to position the country to become one of the top 20 economies in the world by the year 2020. To achieve this objective within its time framework, more effort is required to adequately take care of the occupational health and safety of workers in this sector, the Construction industry. This paper aims to explore the various causes of accidents in the sector i.e., injuries from machines, human factors, neglect to adherence of regulations on health and safety of workers on site by the stakeholders, lack of provision of health facilities etc., and suggest possible preventable measures. Thus, conclusion, recommendations and suggested solutions for the prevention of accidents in the site workshop and on fieldworks is based on the identified problems from its findings. Other scholars however observed that the implementation of a new international standard: Occupational Health and Safety Assessment Series (OSAS) 18001 is not yet commonly adopted in the industry. This paper covers the basic preventable measures to curb the frequent occurrence of accidents in this sector. Therefore, the health and safety of different categories of millions of people that work in the Construction industry must be taken care of seriously, for the realization of the Nigerian vision 20: 2020 goals.**

Keywords: Built-environment, Health and Safety, Accidents, Prevention, Vision 20: 2020.

INTRODUCTION

THE CONSTRUCTION INDUSTRY**:** The "Construction Industry" in its widest sense covers a wide range area of work. They all work together toward the same purpose, i.e. the provision of shelter and services to the population as a whole. Construction industry is complex in nature due its daily operation of activities.

Hence, a building site can be a dangerous environment due to various works that take place on daily basis simultaneously. The geographical location and environmental conditions of the immediate environs of the building structures also have significant effect on its behavioural pattern (Tyler, 1996). The entire Construction industry is confronted with high risk of fatal injuries from varying work environment.

The construction industry offers employment to millions of people all over the world particularly in Nigeria where about 20% of the population is engaged in this vital sector of the economy. Therefore, wherever human activities take place in such manner, injuries or accidents become inevitable. The role of occupational health and safety in the construction industry becomes imperative and of a necessity.

The "workers" in this particular field of job is exposed to some risks inherent in the works and posed safety hazards. Appropriate measures and steps need to be put in place adequately in order to control the occurrence of various accidents on site so that it can be reduced to the barest minimum and if it cannot be totally eliminated at all. The lives of the craftsmen, skilled workers, personnel and professionals must be properly protected against injuries or any other related harms while on the site work.

Akinsola (2006) said, the existence of building structures is a basic necessity in every society. Occupational health is defined by the International Labour Organisation (ILO) and the World Health Organisation (WHO) as "the promotion and maintenance of the highest degree of the physical mental and social well-being of workers in all occupation" (Kohl and Jeyaratnam, 2001, Gribb *et al.*, 1999). According to Gribb *et al.*, 1999, less effort is directed towards health matters in the industry.

AIM AND OBJECTIVES

The aim is to critically examine the root causes of accidents in the industry, identify factors responsible for its occurrences and proffer visible, achievable and practicable solution on its preventable measures by the stakeholders.

The following specific objectives are envisaged:

- To evaluate the remote causes and factors responsible for injuries/fatal accidents in the sector.
- To evaluate preventive and proactive approach which foresee, identify and prevent accidents or hazards before they turn to bad occurrences with unexpected or unpredictable consequences.

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- To investigate how prevention is effective, always better and less costly than treatment and rehabilitation (curative measure).
- To evaluate how preventable measures can ensure workers health is not adversely affected by their work and work is not affected in return by poor health (i.e. mutual benefit).
- To present how good health and safety of workers foster healthy workforce leading to increased productivity for the business owners and the economy at large; healthy workforce is the best asset in any industry.
- To critically examine how it also reduces work related sickness absence and it helps businesses to attain compliance with the relevant laws, thus saves cost by reducing potential claims and litigations.

HEALTH: "Health is generally defined as, to be in a free-state of mind, mentally, spiritually, physically and socially" total well-being of mind.
The Construction industry serves as a catalyst in the development of the nation's economic growth. So, the millions of "workers" that engage in this sector of the economy, must be safe from all site risks and be in good health condition for the rapid economic development of the country, in achieving vision 20: 2020. The concept of development is multi-dimensional in nature, scope and structure etc.
Nnoli and Nnodozie (2004), see development as a phenomenon associated with changes in man's ability and creative energy. It is a process of actualizing man's inherent capacity to live in a better and more rewarding life. It involves increasing skills and capacity to do things, greater freedom and responsibility and total well-being.

SAFETY REGULATIONS: This is the avoidance or act of prevention of injury, harm, accidents and even death to the people on construction site during working period either in a workshop or on the field (site).
The health and safety regulations help you to avoid methods that might endanger yourself and others including equipment while carrying out your workshop practices or site/field works etc. The significant of the occupational health and safety in the built environment in achieving the goals of the vision 20: 2020 is very paramount as a key factor. A comprehensive health packages for the citizenry and provision of adequate housing units for the entire populace are among the aims, objectives and goals of Mr President for vision 20: 2020.
This paper intends to state clearly and categorically the role of occupational health and safety in Construction industry, identify causes of accidents in the built-environment, and suggest possible ways (solutions) to reduce it to the barest minimum, and improved on the health and safety of workers in the construction industry in order to make Nigeria one of the wealthiest nation of the world by the year 2020.
"A healthy nation is a wealthy nation", then a healthy and safety worker would be productive in the sector of the economy where he/she contributes his quota positively to the growth of the nation at large.

THEORETICAL FRAMEWORK

The Construction industry mode of activities is complex in nature and the operational production processes make it to be prone to serious injuries and most times, fatal accidents occur. Available statistics show that developing countries are faced with this challenge mostly as it affects health and safety issues in the construction works. In Nigeria for example, where records of building collapse is very high in recent years, records abound on the death toll due to fatal accidents resulting from collapsed buildings that were under construction stages. Serious injuries were also at highest level throughout the country especially 2010-2011 at its peak of collapsed building reports.
Manual labour is more prevalent in rural and semi-urban areas where construction works take place often. Protective material is not available to large numbers of workers and skilled workers walked bare footed while mixing concrete from early in the morning till late in the night, no rain boots, no hand gloves, no nose or mouth masks to guard against dust from cement chemicals. Women who carried their children on their backs worked on construction sites from sunrise till sunset (dawn to dusk) on daily basis for a week or more, there is no provision for their health and safety while embarking on site works. There is either little, poor or no visible available provisions as issue of construction health and safety is concern by the employers to their workers at all. Occupational health and safety is a strange phenomenon to the indigenous Construction firms (Contractors). Therefore, the occupational health and safety issues both in developed nations and developing countries of Africa and in other regions of the world pose a serious concern for any serious minded Professionals in the Building industry. This vacuum forms the basis for this study to address this important and relevant aspect of the Construction industry.

LITERATURE REVIEW

The Construction industry is a broad sector and contributes immensely to the nation's economic growth. Though many scholars have talked about various areas within this sector, even to some extent, health and safety issues have been discussed likewise. However, there is a gap yet to be critically looked into; this study focuses on the causes of accidents and prevention in occupational health and safety in the Construction industry. The paper highlights the types, categories and factors responsible for the causes of accidents in the sector and presents visible, achievable and practicable preventable measures to eliminate this monster inherent in the industry. The Health and Safety at Work Arts (HASAWA) stated clearly its four main (core) objectives as follows:

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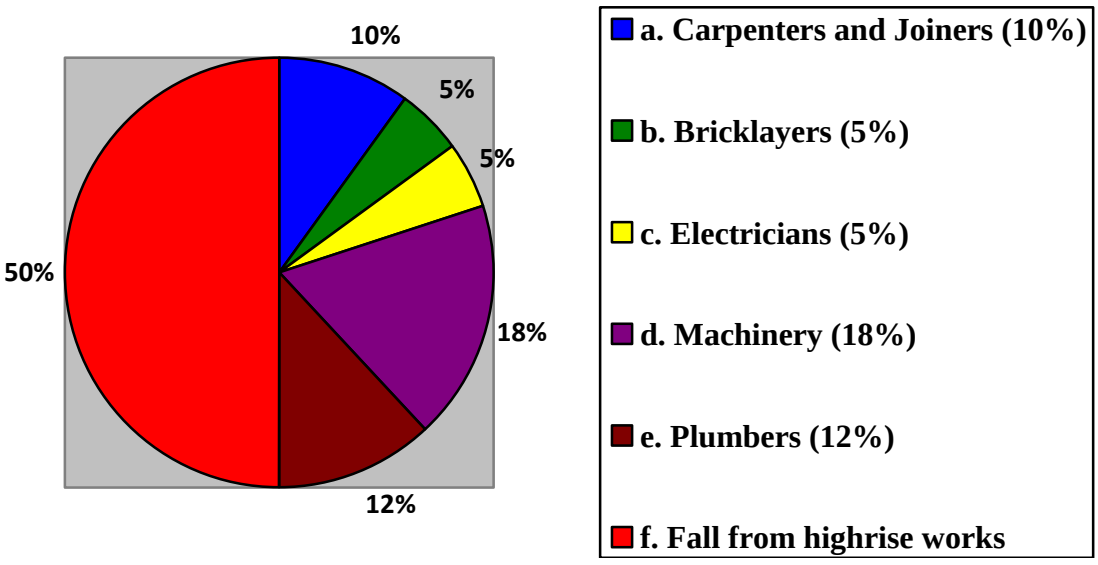
- To secure the health, safety and welfare of all persons at work.
- To protect the general public from risks to health and safety arising out of work activities.
- To control the use, handling, storage and transportation of explosives and highly flammable substances.
- To control the release of noxious or offensive substances into the atmosphere.

However, these noble objectives can be achieved only by involving stakeholders and also, everyone in health and safety matters in the industry and this include:

- Employers and management.
- Employees (and those undergoing training).
- Self-employed in the sector.
- Designers, manufacturers, professionals and suppliers of equipment and materials to the industry.

Accident statistics showed that each year, there are some 15, 000 accidents reported to the health and safety executives which occur during building related activities in Britain, United Kingdom.

Thus, this paper critically examines the occupational health and safety issues in the Construction industry with a focus on the causes and preventable measures based on the identified responsible factors. The stakeholders in the industry have a major role to play to achieve practicable solutions.



Information about the causes of fatal accidents and the breakdown of reported accidents by occupation within the sector.
Source: Accidents report on Construction industry (2002)

METHODOLOGY

Mainly both primary and secondary sources of data were collected and used for this research. Thus, the primary data were those collected through the instrument of questionnaire, interviews, reconnaissance, survey and personal visitation to five Construction companies, 3 in the North central, and 2 in the South western parts of the country due to their widespread operations across the country. The questionnaire was administered to gather relevant information mainly on causes of accidents in construction sites and factors responsible for such occurrences, any visible mitigation by the firms and stakeholders in respect to occupational health and safety issues in the industry. The data acquired was used to supplement the secondary data. Four hundred and seventy five questionnaires in all were distributed to the respondents.

The respondents were then selected using simple random sampling techniques. The choice of this technique is purposely aimed at giving every element the choice of being selected. Four hundred and fifteen respondents accurately completed and returned their questionnaires in the study area.

Secondary data include trade magazines, journals on health and safety in industries.

METHOD OF DATA ANALYSIS

The statistical tool employed is the mean and was computational using the formula:

$$\textbf{Mean } \bar{X} = \frac{\sum fx}{\sum f}$$

Where: f = frequency of observation
x = value of observation

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RESEARCH FINDINGS

Table 1: Trade/Sectional Distribution In The Five Construction Companies

Trade /Section	Bulletine Construction	C & C Construction	Dantata & Sawoe Company Nig. Ltd.	Julius Berger Nig. Ltd	Techno Exportory
Carpenter & Joiners	20	18	15	22	12
Bricklayer & Mason	18	12	12	18	10
Scaffolder	18	10	10	12	8
Plumber	12	10	10	10	6
Electrician	12	8	6	8	6
Steel Fixer	10	8	6	10	7
Painter	10	7	6	8	6
Machine Operator	5	6	5	7	5
Transport (Drivers) Of Truck, Water Tanker, Within The Firms)	5	6	5	5	5
Total	90	85	75	100	65

Source: Fields Survey on Occupational Health & Safety by Trade (2012)

Table 1 shows the Trade/section distribution in the Fire Construction Companies. It shows that Julius Berger has majority of the Technical trade workers (100), followed by Bulletine Construction (90), while Dantata and Sawoe have (75), and finally Techno Exportory has (65) respectively. This clearly shows that the cadre of workers that are mostly faced with health hazard challenges largely cuts across the five Construction companies.

Table 2: Records On Injuries And Fatal Accidents In The Sector From 1991 -2015

ACCIDENT REPORTS ON CONSTRUCTION COMPANIES FROM 1991 -2015																		
Year	1991		1992		1993		1994		1995		1996		1997		1998		1999	
Asian & European Continents	I	FA	I	FA	I	FA	I	FA	I	FA	I	FA	I	FA	I	FA	I	FA
	12	8	15	10	8	12	13	8	9	11	16	12	14	11	16	12	18	14
	2000		2001		2002		2003		2004		2005		2006		2007		2008	
	10	8	14	7	11	8	12	5	11	4	9	6	12	10	13	9	14	10
	2009		2010		2011		2012		2013		2014		2015					
	12	10	4	8	7	5	8	6	5	2	4	1	6	2				
Sub Total	34	26	33	25	26	25	33	19	25	17	29	19	32	23	29	21	32	24
African Continent	1991		1992		1993		1994		1995		1996		1997		1998		1999	
	I	FA	I	FA	I	FA	I	FA	I	FA	I	FA	I	FA	I	FA	I	FA
	10	9	3	5	8	6	10	4	7	9	8	6	11	8	17	12	10	12
	2000		2001		2002		2003		2004		2005		2006		2007		2008	
	11	12	12	8	10	9	11	14	8	10	11	12	9	9	10	11	9	7
	2009		2010		2011		2012		2013		2014		2015					
	12	10	15	22	23	34	19	12	12	10	11	9	10	8				
Sub Total	33	31	30	25	41	49	40	30	27	29	30	27	30	25	27	23	19	19
TOTAL	67	57	63	50	67	74	73	49	52	46	49	46	62	48	56	44	51	43

Note: I = Injuries, FA = Fatal Accidents

Source: Fields Survey of Accidents in Construction Companies from 1991-2015 (2014/2015)

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Table 3: Number Of Fatalities Associated With Various Trades Within The Construction Industry From 1991-2015

Trade	Machine Operator (Machinery)	Scaffolders	Plumbers	Carpenters & Joiners	Electrical	Steel Fixers	Bricklayers & Mason	Transport	Mean %
Construction Site A	35	50	28	49	19	25	14	10	28.8
Construction Site B	36	54	27	44	18	24	12	13	28.5
Construction Site C	37	55	29	42	22	27	11	12	29.4
Construction Site D	34	52	26	48	16	25	14	10	28.1
Construction Site E	38	53	30	45	18	28	17	14	30.4

Note: Each Figure Represents the Total numbers of Respondents
qSource: Fields Survey of Accidents in five (5) Construction Companies 2015

Table 3 shows the pattern of respondents by trade of how accidents occurred in each section of Construction sites A-E. Records show from 1991-2015; construction on Site E recorded 243 accidents equivalent to 30.4%, followed by construction on Site C, 235 accidents equivalent to 29.4%, construction on Site A have 230 accidents equivalent to 28.8%, construction on Site B records 228 accidents equivalent to 28.5%, while that on construction Site D records 225 accidents which represents 22.5%. Within this period which this research focused on, it is observed that accident records among the 5 construction companies comprise of Machine operators = 180, Scaffold = 269, Plumber = 140, Carpenter and Joiner = 228, Electrician = 93, Steel fixer = 129, Bricklayer and Mason = 68, and Transport (trucks, water tanks, etc.) = 59, in that order.

Table 4: Statistics On Construction Industry Health And Safety Reports On Continents

Year	ASIAN CONTINENT			
	Injuries	Fatal Accidents	Total	Mean %
1991-1999	82	98	180	90.0
2000-2008	106	67	173	86.5
2009-2015	46	34	80	40.0
TOTAL	234	199	433	

Source: Adopted from World Health Accident Reports on Industries (2014/2015)

Table 5: Construction Health And Safety Reports

Year	EUROPEAN CONTINENT			
	Injuries	Fatal Accidents	Total	Mean %
1991-1999	78	84	161	80.5
2000-2008	85	42	127	63.5
2009-2015	35	18	54	27.0
TOTAL	198	144	342	

Source: Adopted from World Health Accident Reports on Industries (2014/2015)

Table 5: In Europe continent, within the same period 1991-1999; records 161, equivalent to 80.3%, from 2000-2008 recorded 127 which represent 63.5%, while from 2009-2015 recorded 54, which represents 27.09%, this also shows a decline to some extent.

Table 6: Construction Health And Safety Reports

Year	AFRICAN CONTINENT			
	Injuries	Fatal Accidents	Total	Mean %
1991-1999	93	157	250	125.0
2000-2008	115	94	209	104.3
2009-2015	124	178	302	151.0
TOTAL	332	429	761	

Source: Adopted from World Health Accident Reports on Industries by each sector (2014/2015)

Table 6: In Africa continent, from 1991-1999, accident records in the sector was 250, which represents 125%, the between 2001-2008, accident records was put at 209 which represents 104.3%, a visible decline was recorded, but, between 2009-2015, it increased to 302 which represents 151%. This clearly shows the adverse effects of building collapse in Nigeria and some other African countries.

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This is a wakeup call to duty as far as occupational health and safety in the sector is concerned in the African continent and including other parts of the globe.

Table 7: Percentage Of Occurrence Of Health Hazards In The Construction Industry

S/NO	IDENTIFIED CAUSES	HAZARDS AND CHALLENGES POSED TO WORKFORCE HEALTH	PERCENTAGE RATING OF EACH OF THE FIVE CONSTRUCTION COMPANIES					
			BULLENTINE CONSTRUCTION	C&C CONSTRUCTION	DANTATA & SAWOE	JULIUS BERGER	TECHNO EXPORTORY	MEAN %
1.	Equipment /Machine Noise	Hearing Impairment	20	30	10	60	50	34.0
2.	Chemical	Irritant	10	10	25	30	30	21.0
3.	Chemical	Allergic Reaction	30	40	30	40	25	33.0
4.	Chemical	Skin Cancer	5	2	5	1	1	2.8
5.	Chemical	Lung Cancer	-	-	-	-	-	-
6.	Dust	Eye Problem (Connectivity)	60	50	50	60	40	52.0
7.	Radiation from Welding	Eye Problem / blindness	50	60	40	50	30	46.0
8.	Dust or Fumes	Asthmatic Attack	10	20	20	10	25	17.0
9.	Dust	Catarrh	20	35	25	20	25	25.0
10.	Exposure to Cold Weather	Cold/Fever	0	0	0	0	0	0
11.	Cement: Inhale of cement dust	Skin Diseases	40	50	50	40	40	44.0
12.	Asphalt	Skin Diseases	5	2	2	1	1	2.2
13.	Heat Radiation: Intensive sun Shine	Skin Diseases	1	1	1	1	1	1.0
14.	Contaminated Water	Diarrhea / Skin Diseases	5	10	10	10	5	8.0
15.	Contaminated Water	Vomiting	5	5	10	5	2	5.4
16.	Contaminated Water	Cholera	0	0	0	0	1	0.2
17.	Physical Health Hazards	Injury due to slip fall / Hit	50	45	35	20	30	36.2
18.	Equipment / Machine	Bruises / Slashes	20	30	20	10	20	20.0
19.	Physical Hazard	Injury to due Electric Shock	5	35	30	40	10	24.0
20.	Equipment (Machine)	Fracture of foot or hand loss or loss of thumb or fingers	30	20	40	50	50	38.0
21.	Temperature (Environment)	Heat Rashes	2	10	5	2	1	4.0
22.	Temperature (Environment)	Fatigue/ Heat Cramp	2	5	1	1	2	2.2
23.	Falling of Object from high Scrappers	Head Injuries or Fracture	10	2	2	1	2	3.4
24.	Falling of worker from high scrappers	Head Injuries or Fractures	10	2	5	2	1	4.0
25.	Collapsing of heavy objects on workers	Complicated Fracture/ Death	2	1	2	2	2	1.8

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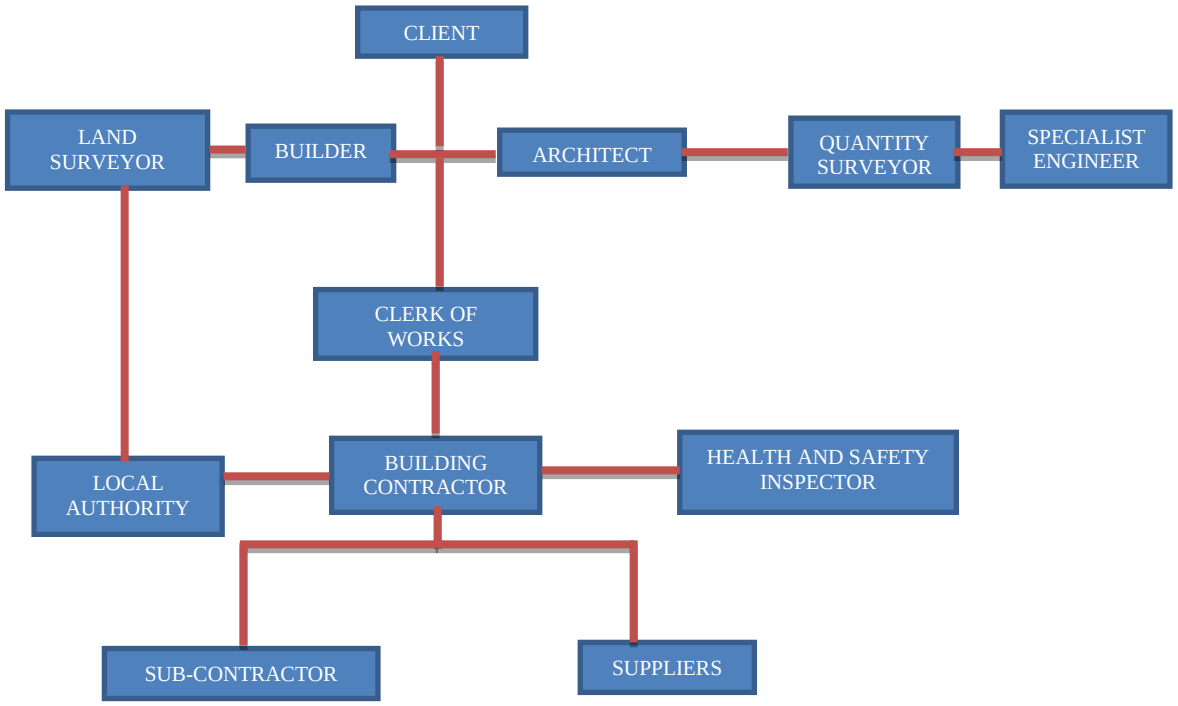
THE COMPONENTS OF A BUILDING TEAM

The construction of a building structure, is a complex process, which require a team of professionals working together to produce the desired results.

This team of professionals, which is collectively known as the building team, is a combination of the following parties:



COMPONENTS OF A BUIDING TEAM
SOURCE: Library Information Services on Construction Team (2008)

The diagram above is a clear diagrammatical representation of the workers in the construction industry. The realization of vision 20: 2020 calls for their health and safety as a priority, their roles is very relevant to the nation. As the whole world is fast becoming a global village, hence, these construction workers should not be left-out in term of "health and safety" that will fast-track and foster economic growth of this particular sector.

"It is one that maintains lasting security from environmental hazards that may threats development achievements by allowing only for acceptable risks (Omolabi, 2003)".

SOME FACTORY ACTS ON HEALTH AND SAFETY REGULATIONS IN THE BUILT-ENVIRONMENT.

The construction industry (building site) is a very complex environment where diverse types of works on building projects is carried out. Some powerful machinery, hazardous materials, scaffolding and trenches create risks for the building workers and other people in the construction area. Accidents will happen on building site, but the number can be reduced by developing the skills that you need to do your work safely. The construction industry has an unenviable record where accidents and personal injury are concerned. Section-7 of part 1 of the health and safety at work etc. Act 1974 states quite clearly: "it shall be the duty of every employee while at work:

To take reasonable care for the health and safety of himself and of other persons who may be affected by his acts or omissions at work, and,

(a) As regards any duty or requirement imposed on his employer or any other person by or under any of the relevant statutory provisions to co-operate with him so far as is necessary to enable that duty or requirement to be performed or complied with.

This section of the Act places a legal responsibility upon the employee to work in a safe manner in respect of himself and his fellow workmen. Failure to do so could result in legal proceedings being taken against him, terminating in a fine or even imprisonment.

ACCIDENTS

DEFINITION: An accident is an unforeseen event causing injury, damage or loss of life that might have been avoided by following correct methods and procedures.

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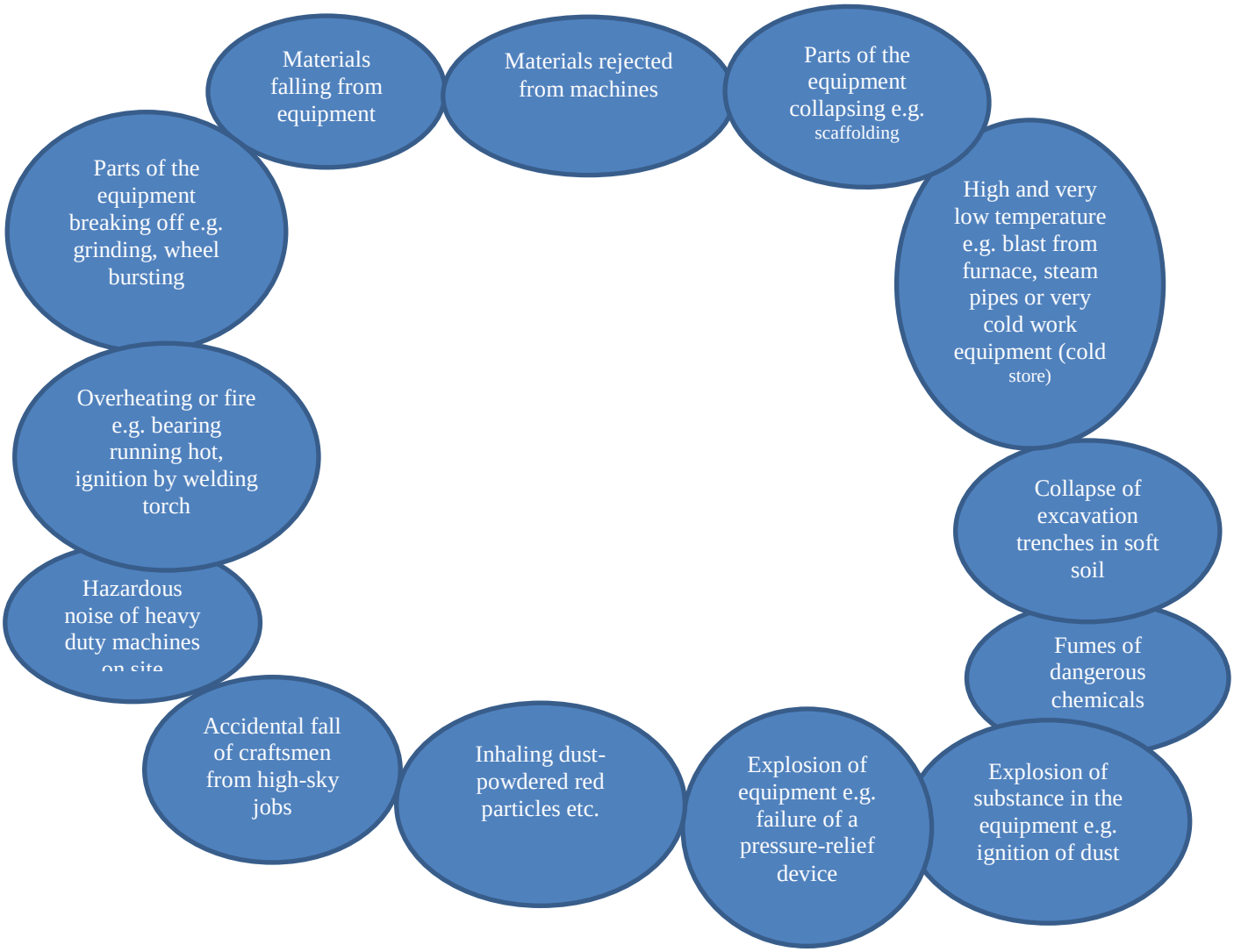
CAUSES OF ACCIDENTS AND ITS STATISTICS

Each year there are some 15,000 accidents reported to the health and safety executive which occur during building related activities in Britain. Reported accidents are those which result in death, major injury, fracture, a week absence from work etc. are caused by noticeable dangerous occurrence.

In Nigeria, cases of accidents on site occur from time to time. Collapsed of buildings on workers while on site-work has claimed many lives around the country. The health and safety execute break down these reported accident figures into the type of accident and the occupations within the industry of those involved. Of the reported accidents by occupation, carpentry and joiners are most at risk with 10% of the total followed by bricklayers at 5.6%, then electricians at 5%.



SOME CAUSES OF ACCIDENTS (SPECIFIED HAZARDS)
Source: Causes of Accident reports on Construction & Statistics (2005)

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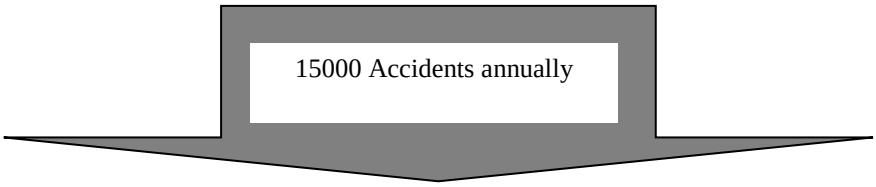

This is Nearly 300 Each week

approximately 60 each working day

or

Over 7 each work hour

or

1 every nine minutes

or these

this is

an average of 1½ deaths each week

REPORT ON CAUSES OF ACCIDENTS AND FREQUENCIES
SOURCE: REPORTS OF ACCIDENTS ON CONSTRUCTION WORKS (2002)

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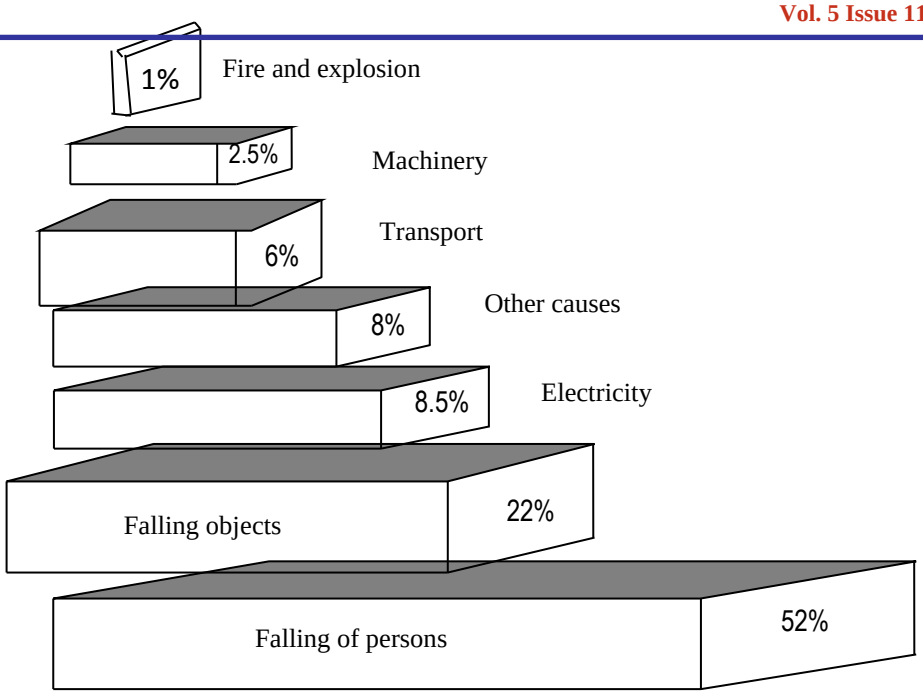
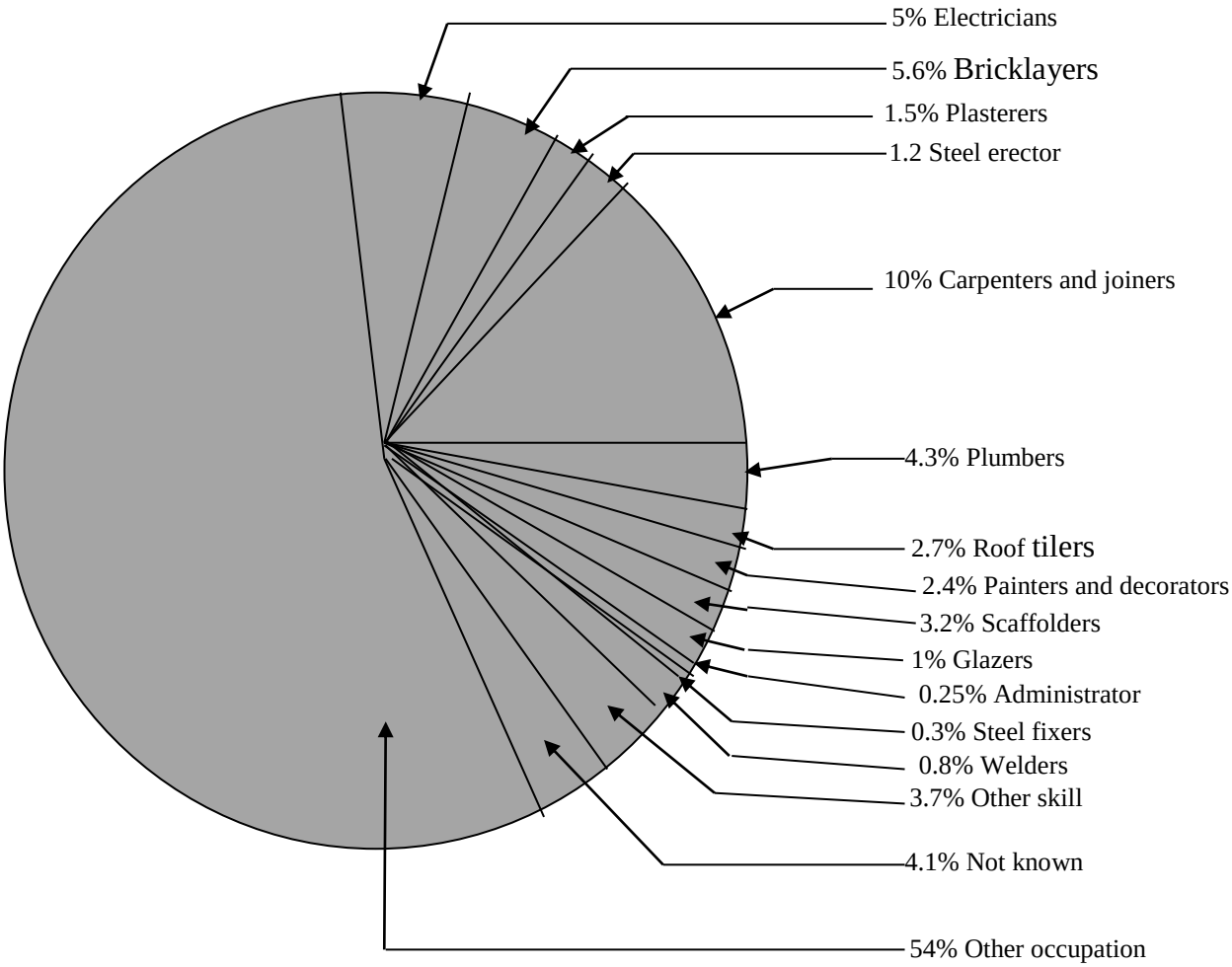


Causes of fatal accidents



Categories of Accidents and its Percentage
Source: Reported accidents on Construction Industry (2004)

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HAZARDOUS SUBSTANCES IN CONSTRUCTION INDUSTRY

SUBSTANCES	HEALTH RISK	JOBS	CONTROLS
DUSTS Cement (also when wet) Gypsum	 SK I ENT SK I ENT	 Masonry, rendering Plastering	Prevent spread, protective clothing, respirator when handling dry, washing facilities, barrier cream.
Man-made mineral fibre	SKI ENT	Insulation	Minimize handling/cutting, respirator, one place overall, gloves, eye protection.
Silica	SKIENT	Sand blasting, frit blasting scrabbling granite, polishing	Substitution – e.g. with grit, silica-free sand; wet methods, process enclosure/extraction; respirator.
Wood dust (dust from treated timber e.g. with pesticide may present extra hazards	SKI ENT	Power tool use in carpentry, especially sanding	Off-site preparation' on site – enclosures with exhaust ventilation; portable tools – dust extraction; washing facilities respirator
Mixed dusts (Mineral and biological)	SKI ENT	Demolition and refurbishment	Minimize dust generation; use wet methods where possible, segregate or reduce number of workers exposed; protective clothing, respirator; good washing facilities/showers, tetanus immunization.
FUMES/GASES Various welding fumes From metals or roads		Welding/cutting activities	Mechanical ventilation in enclosed spaces; air supplied helmet, elsewhere good general ventilation
Hydrogen sulphide	SKI ENT	Sewers, drains, excavations manholes	All work in confined spaces – exhaust and blower ventilation; self-contained breathing equipment confined space procedures.
Carbon monoxide/nitrous oxide	SKIENT	Plant exhausts	Position away from confined spaces, where possible maintain exhaust filters; forced ventilation and extraction of fumes.
SOLVENTS In many construction products – paints, adhesives, strippers, thinners, etc.	SKIENT	Many trades, particularly painting, tile fixing, spray application is high risk. Most brush/roller work less risk. Regulation exposure increases risks	Breathing apparatus for spraying, particularly in enclosed spaces; use of mist less/airless methods. Otherwise ensure good general ventilation. Washing facilities, barrier cream.
RESIN SYSTEM Isocynates (MDI: TDI)	SKI ENT	Thermal insulation	Mechanical ventilation where necessary; respirators protective clothing, washing facilities, skin checks, respirators checks.
Polyurethane paints	SKI ENT	Decorative surface coatings	Spraying – airline/self-contained breathing apparatus; elsewhere good general ventilation, one piece overall, gloves, washing facilities
Epoxy	SKI ENT	Strong adhesive applications	Good ventilation, personal protective equipment (respirator; clothing) washing facilities, barrier cream as above.
Polyester	SKI ENT	Glass fibre claddings and coatings	
PESTICIDES (e.g. timber preservatives, fungicides, weed killers)	SKIENT	Particularly in situ timber treatment, handling treated timber	Use least toxic material. Mechanical ventilation, respirator, impervious gloves one piece overall and head cover. In confined spaces breathing apparatus. Washing facilities, skin checks if necessary biological checks. Handle only dry material
ACIDS/ALKALIS	SK ENT	Masonry cleaning	Use weakest solutions. Protective clothing, eye protections. Washing facilities (first aid including eye bath and copious water for splash removal)
MINERAL OIL	SKIENT	Work near machines, compressors, etc. mould release agents	Filters to reduce mist. Good ventilation, protective clothing. Washing facilities'; barrier creams. Skin checks.
SITE CONTAMINANTS e.g. arsenic, phenols, heavy metals, microorganisms etc. e.g. wells disease, tetanus, hepatitis B	SKIENT	Site re-development of industrial premises or hospitals- particularly demolition round work and drain/sewers	Thorough site examination and clearance procedures, respirators, protective clothing. Washing facilities/showers. Immunization for tetanus.

Source: Report on construction industry (2000)

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ELECTRICAL HAZARDS

Electrical equipment of some kind is used in every factor. Electricity should be treated with respect. It cannot be seen or head, but it can kill. Even if it is not fatal, serious disablement can result shock and burns. Also, a great deal of damage to property and goods can be caused, usually through fire or explosion as a result of faulty wiring or faulty equipment. The electricity at work regulations 1989 came into force on 1st April, 1990. The purpose of the regulations is to require precautions to be taken against the risk of death or personal injury from electricity in work activities.

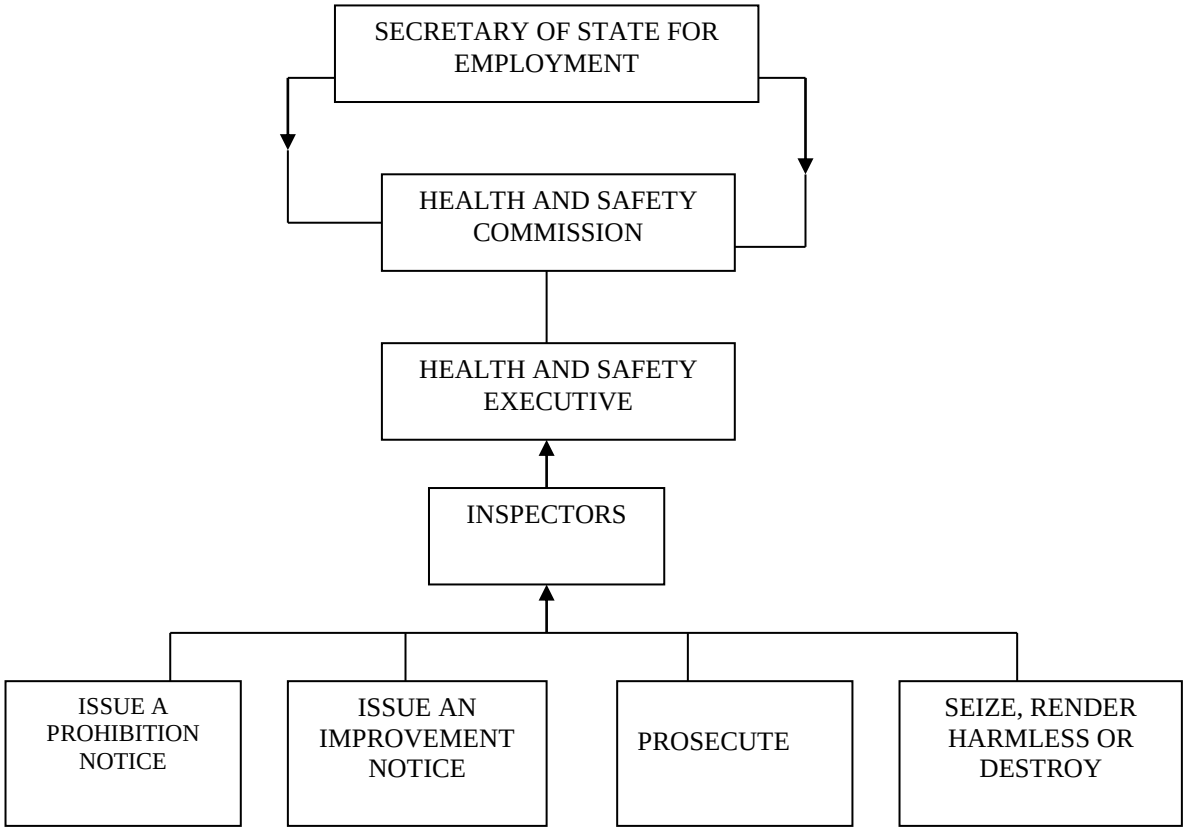
Some of the electricity hazards are: Electric shock, Electric burn, Fire outbreak, Arcing, Explosion.

ELECTRICAL PRECAUTIONS

Where it is possible for electrical equipment to become dangerous if a fault should arise, then precautions must be taken to prevent injury.

These precautions are: Double insulation, Earthling, Use of safe voltage, Circuit breakers etc.

Provision of stand by fire extinguishers, like spray foams, dry powder, carbon dioxide (CO_2 gas), and Halon.



SOURCE: HEALTH AND SAFETY ORGANIZATION (1995)

THE CONTROL OF SUBSTANCES HAZARDOUS TO HEALTH REGULATION (COSHH)

Where people use or are exposed to hazardous substances, the COSHII regulations require:

- The assessment of risks involved.
- The prevention of exposure to risk.
- Measures taken to adequately control it.
- Monitoring of the effectiveness of the measures taken.

Identification: People may be exposed to risks either because they handle a hazardous substance, or because during the work a hazardous substance is created. Manufacturers and suppliers of such substances are required to provide safety data sheets for reference purposes.

Protection: If exposure cannot be prevented, or adequately controlled using any of the above, also use personal protective equipment (PPE).

- ✓ Always wear protective clothing. Overalls, gloves (for protection and anti-vibration), boots, helmets, ear protection, eye protection goggles or visors and dust masks or respirators as appropriate.
- ✓ The use of barrier and after-work creams is recommended to protect skin from contact dermatitis.
- ✓ Ensure items of PPE are kept clean, so that they do not themselves become a source of contamination.

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- ✓ All items of PPE should be regularly maintained, checked for damage and stored in clean dry conditions.
- ✓ Replacement items of PPE and spare parts must be available for use when required.

Personal hygiene: Protection does not stop with PPE. Hazardous substance can be easily transferred from contaminated clothing and unwashed hands and face.

THE CONTROL AND PREVENTION OF ACCIDENTS IN THE BUILT ENVIRONMENT AND VISION 20: 2020

The role of the construction industry in the economy sector of Nigeria cannot be overemphasized. The basic objective and aim of vision 20: 2020 is to make our nation one of the most industrialized country of the world in term of economic growth and prosperity.

If this great vision of Mr President must come true, then the "health and safety" of millions of workers that are engaged in this great industry must be seriously guarded and protected for the realization of the set goal. Therefore all the necessary machinery that would assist and promote the health and safety of these workers should be handled with all the seriousness involved by the government, corporate bodies, the private organized sector and all the statutory bodies concerned in this matter.

The human resources that co-ordinate all the other factors of production must be adequately take care of in term of health and safety at work provisions, so that greater output of production can be achieve as targeted. When the health and safety of workers in site/field work is protected and guaranteed, then maximum out put that will enhance the economic growth of the sector will be visible at the end towards the goal of vision 20: 2020. The control and prevention of accidents in construction industry in this respect is very important to all.

PREVENTIONS

(Bruce J. Black, 1997).

PERSONAL PROTECTIVE EQUIPMENT AT WORK REGULATIONS 1992

Much old factories Act 1961 has been replaced. Its primary objective is to ensure that provision of safe work equipment and its safe use. PPE is defined is all equipment which is intended to be won or held to protect against risk to health and safety. This includes most types of protective clothing and equipment such as: eye, head, foot and hand protective clothing for the body.

a. EYE PROTECTION:- Serves as a guard against the hazards of impact, splashes from chemicals or molten metal, liquid droplets (chemical mists and sprays), dust, gases and welding arcs. Eye protectors include safety spectacles, eye-shields, goggles, welding filters, face shields and hoods.
b. HEAD PROTECTION:- These includes industrial safety helmets to protect against falling objects or impact with fixed objects, industrial scalp protectors to protect against striking fixed obstacles, scalping or entanglement, and caps and hairnets to protect against scalping and entanglement.
c. FOOT PROTECTION:- These includes safety boots or shoes with steel toe caps, foundry boots with steel caps, which are heat resistance and designed to keep molten metal, Wellington books to protect against water and wet conditions, and antistatic foot wear to prevent the build-up of static electricity on the wearer.
d. HAND PROTECTION:- Gloves of various design provide protection against a range of hazards including cuts and abrasions extremes of temperature (hot and cold), skin irritation and dermatitis and contact with toxic or corrosive liquids. Barrier creams may sometimes be used as an acid to skin hygiene in situation where gloves cannot be used.
e. PROTECTIVE CLOTHING:- Types of cloth used for body protection include coverall overalls and aprons to protect against chemicals and other hazardous substance outfits to protect against cold, heat and bad weather , and clothing to protect against machinery such as chain saws. Types of clothing worn on the body to protect the person include high visibility clothing, life-jackets and buoyancy aid.

PROVISION AND USE OF WORK EQUIPMENT REGULATIONS 1992 (PUWER)

It primary objective is to ensure that provision of safe work equipment and its safe use. Work equipment has wide meaning and is broadly defined to include anything from a hand tool, through machines of all kinds, to a complex plant such as a refinery. Power cover the health and safety requirement in respect of the following:-

(a) The suitability of work equipment:- Equipment must be suitable by design and construction for the actual work it is provided to do.
(b) Maintenance of work equipment in good repair:- From simple checks on hand tools such as loose hammer heads to specific checks on lifts and hoist. When maintenance work is carried out it should be done in safety and without risk to health.
(c) Information and instruction on use of the work equipment:- Including instruction sheets, manuals, or warning labels from manufacturers or suppliers. Adequate training, for the purpose of health and safety in the use of specific work equipment.

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EMPLOYERS' AND MANAGEMENT DUTIES

Employers have a general duty to ensure the health and safety of their employees, visitors and the general public. This means that the employer must:-

1. Provide and maintain a safe working environment.
2. Ensure safe access to and from the work place.
3. Provide and maintain safe machinery, equipment and methods of work.
4. Ensure the safe handling, transport and storage of all machinery, equipment and materials.
5. Provide their employees with the necessary information, instruction, training and supervision to ensure safe working.
6. Prepare, issue to employees and update as required a written statement of the firms' safety policy.
7. Involve Trade Union safety representatives (where appointed) with all matters concerning the development, promotion and maintenance of health and safety requirements.

Therefore, an employer is not allowed to charge an employee for anything done, or equipment provided, to comply with any health and safety requirement. (Peter B., 2002).

HEALTH AND SAFETY INSPECTOR

The health and safety inspector (also known as the factory inspector) is employed by the Health and safety Executive. It is the inspector's duty to ensure that the government legislation concerning health and safety is fully implemented by the building contractor.

In the same vein, the promulgation of urban and Regional Planning Law No. 88 of 1992 is another conscious effort that perhaps remains the most recent important involvement of the federal Government in Urban Planning activity in Nigeria. The efforts notwithstanding, it is worthy to Note that the political will by the government to fully implement the policy and decrees has been very slow (Abiodun, 2005; Adeniran, 2007).

DISCUSSIONS ON RESEARCH FINDINGS

Table 2 evidently indicates the statistical figures consisting of both records of injuries and fatalities in Construction companies from 1991-2015, operating in 3 continents of Asia, Europe and Africa. From the data analysis, there is clear indication that Africa has the highest number of accidents (125%) from 1991-1999, followed by Asia (90.0%), while Europe is (80.5%) within the year range. However, there is a little decline between 2000-2008, where Africa (104.3%), Asia (86.5%), and Europe (63.5%) respectively. Nevertheless, from the study findings, collapse of buildings contributed immensely to the rise of accident reports between 2009-2015, especially in Nigeria, then fatalities and injuries rose up again within this period under study. Thus, between 2009-2015, Africa (151%), Asia (40%) and Europe (27%). The survey showed that reports of accidents are inherent in the Construction industry around the world, only its magnitude differs.

Table 4: In Asia continent, from 1991-1999, 180 accidents occurred which represents 90%, from 2000-2008, 173 accidents recorded represents 86.5%, while from 2009-2015, 80 accidents recorded which represents 40%. This shows a decline of accidents in the sector.

Table 5: In Europe continent, within the same period 1991-1999; records 161, equivalent to 80.3%, from 2000-2008 recorded 127 which represent 63.5%, while from 2009-2015 recorded 54, which represents 27.09%, this also shows a decline to some extent.

Table 7 above shows clearly that due to the complex nature of the Construction industry, the workforce in the sector is exposed to a lot of hazards, while on their duty post on a daily basis. Eye defects primarily caused by radiation from welding, dust, hearing impairment caused by heavy equipment/machine noise has a percentage rating of 60% and is ranked 1st. Others are allergic reaction and irritation due to daily exposure to cement dust and skin diseases. The craftsman who is most vulnerable to these health hazards is ignorant of the immediate and long-term effects and the health challenges some usually contract in the working environment and under unsafe working conditions. Injuries due to slip fall, or hit, and injury from electric shock are among physical health hazards the workforce in the industry are seriously exposed to. These health hazards are ranked 2nd, 3rd, 4th and 5th respectively with a percentage rating of 50%, 45%, 40%, and 35% in that order. Accidents from heavy duty equipment/machines that are electrically operated is among the high ranking that is responsible for fracture of foot, or hand loss, loss of thumb or fingers and bruises/slashes as the case may be. Findings from this research has clearly shown that occupational health hazards occurred highest in Julius Berger, this is due to heavy duty equipment /machines used in their site works as their mode of operation.

Accidents are lowest in Techno-exportory and, Dantata and Sowae, because heavy duty equipment/machines are not so frequently used for their site operations.

Data analysis have shown that Construction companies with heavy mechanical plants/machines due to their complex nature of operation, posed more risks of accidents on site work to the workforce operating them and other workers too who are in that immediate environment. Thus, preventable measures against its frequent occurrences become inevitable, and should be taken seriously by all the stakeholders concerned.

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CONCLUSION

World Health accident reports on industries by sector and similar studies by other scholars have shown that; Globally, Construction workers are three times more likely to be killed and twice as likely to be injured, as compared to workers in other occupations. In 1999, 11% of injuries and 30% of fatalities occurred on Construction sites in the U.S.A., and Italy, 25% of Construction works related accidents were recorded. In Nigeria 2005, 20 workers died in Port Harcourt city in a construction site resulting from building collapse while works was in progress. Records confirmed that in Hong Kong 1993, a total fine of 17 million on 3001 convictions for health and safety offences, where a fine of 1 million accounts for 1382 related to Construction site alone.

So, from the foregoing, it becomes imperative that the findings and recommendations from this research work should be critically looked at, and applied appropriately by the stakeholders concerned.

RECOMMENDATIONS

- ✓ That it behoves on the employees to take proper care of themselves and their other co-worker men by making provisions to wear complete health and safety kits while on site.
- ✓ That the employers should provide all the health and safety facilities in the Construction industry as specified.
- ✓ The Federal, State and Local governments should enforce the factory law on Health and Safety Regulations for compliance.
- ✓ Provision of site clinics and provision of standby ambulance by Construction companies to take care of injured workers while on site, should be made compulsory and enforced by the relevant government agencies concerned.
- ✓ Construction task force should be in the Construction industry to oversee the issues of health and safety hazards, proper health care of workers be primarily taken serious by the organisations or "bodies" that are concerned with such.
- ✓ All categories of workers on site should be adequately covered by construction worker health insurance scheme for their total social well-being.
- ✓ Financial compensations should be given to some categories of workers where their life-health is put at risk due to some chemical fumes or electrical hazards; they are exposed to during their working hours in the field.
- ✓ All defaulters' failure to adhere to all health and safety regulations should be sanctioned accordingly.
- ✓ All Professionals within the built-environment should be trained in health and safety executives for construction works.
- ✓ Relevant stakeholders and the private sector should partner together on health and safety executives for construction industry workers.

REFERENCES

[1] Abiodun,Y. (2005). "Globalization and Urban Development in Nigeria". Proceedings of NITP 37th Annual Conference on Four Decades of Town Planning in Nigeria the Challenges Ahead.
[2] Akker, L. (1999). Implementation of safety and health on construction site. Proceedings 2nd international conference of CIB working commission W99 March, Single, A; Hinze, J; Cobic, R.J. (eds), Honlulu, pp 681-687 Anonymous (2006). Five principles of improving construction safety. Journal of safety record, 107: 4-5.
[3] Bamisile, A. (2004). Building Production Management. Foresight Press Ltd, Lagos, Nigeria.
[4] Berger, J. (2006). Health and safety handbook for Julius Berger Nigeria plc employees, Abuja, Nigeria.
[5] Bruce, J.B. (1997). Workshop processes, practices and material. Arnold publisher, 338 Easton road, London Nuls 334.
[6] Coble R.J; Haupt, T.C. (1999). "Construction safety in developing countries". In singh, A; Hinze, J.H.
[7] Coble, R.J. (Eds). Implementation of safety and health on construction sites, A.A. Balkema, Rotterdam.
[8] Deacon, C.H; and Smallwood, J. (2001). Hazardous and chemical substances in the South Africa Construction industry. African Newsletter on occupational health and safety, 1: 17-19.
[9] Hamalainem, P; Takala, J; and Saarela, K.L. (2006). Global estimates of occupational accidents, safety science. 44: 137-156.
[10] Idoro, G.I. (2008). Health and safety management efforts as correlates of performance in the Nigerian developing studies.
[11] Helender, M. (1991). Safety hazards and motivation for safe work in the Construction industry. International Journal of Industrial Ergonomics.
[12] HSE (2003). Health and safety performance in the Construction industry. Progress since February, 2001 Summit Second Report by Kelvin Myers. Chief Inspector of construction. United Kingdom (U.K.).
[13] Idoro, E.I. (2004). The effect of Globalisation on safety in the Construction industry in Nigeria Proceedings of International Symposium on Globalisation and Construction, November, School of Civil engineering, Aslen Institute of Technology, Bangkok, Thailand.
[14] Koh, D; and Jeyaratnam, B. (2001). "Work and Health" in Textbook of occupation Medicine practice, Koh, H. Sig, CK; & Jeyaratnam I. (eds). 2nd edition. World Scientific, Singapore.
[15] Nnoli and Nnodozie (2004). The state, civil service and underdevelopment in Nigeria, Enugu. Johnkens and Willy publishing (Nig) Ltd.
[16] Okoli, O.G. (2009). Occupational health and safety (OHS) assessment in the Construction industry.
[17] Omolabi, A.O. (2003). The need for new approach to an effective urban environment, in proceedings of the 3rd National Conference on Urban Planning and Selected Issues.
[18] Peter, B. (2002). "A building craft foundation". Nelson Thomas Ltd Publisher 27 Bath Road GL5377h U.K.
[19] Tyler, H.A. (1996). Environmental Science Level IV New York, Van Norstrand Reinhold Company, pg. 182-197.
[20] Umeokafor, N; Isaac, D; Jones, K.G. and Umeadi, B. (2013). Enforcement of occupational safety and health regulations in Nigeria: An exploration proceeding of the 1st international scientific forum, 3: 92-103.
[21] Umeokafor, N.I; Umeadi, B. and Jones, K.G. (2014). Compliance with Occupational Health and Safety Regulations: A Review of Nigeria's Construction Industry. In Ejohwonu, O. and Oshodi, O. (eds) proceedings of the 3rd international conference on infrastructure development in Africa ICDJA 2014, pg. 70-84.