# PATTERN OF ACCIDENTS IN BUILDING CONSTRUCTION SITES IN OBIO AKPOR LOCAL GOVERNMENT AREA OF RIVERS STATE, NIGERIA

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## ABSTRACT

**BACKGROUND**

Building construction workers are engaged in a dangerous job, exposing them to an array of hazards. Construction accidents cause deaths, injuries and economic loss each year. The leading cause building site accidents include falls from unsafe working conditions and scaffolding. This study was to determine the pattern of hazards / accidents in building construction sites in Obio Akpor Local Government Area of Rivers State Nigeria.

**METHOD**

This descriptive cross-sectional study recruited 400 consenting respondents (366 males and 34 females) using a multistage sampling system. They responded to closed ended, structured interviewer/self administered questionnaires which probed socio-demographics, occupational history, knowledge and behavior towards workplace hazards. There was also a walk-through survey of sampled work sites. Data collected in Excel spread sheet were analyzed and presented in descriptive and analytical statistics..

**RESULTS**

This showed 278 (69.50%) of the workers agreed to being exposed to hazards at the work place. The hazards in order of prevalence include noise (31.46%), falling off from the ladder or height (29.25%), slips, trips and low falls (29.04%), dust (24.39%), heat (25.51%), flame/fire (24.94%), puncture wound (22.54%), struck by falling objects (19.18%), gases or vapors (17.27%), fumes (16.16%), cold (18.08). Injuries sustained in this study include musculoskeletal (46.85%), Puncture wounds (32.87%), Electrocutions (8.39%).

**CONCLUSION**

Hazards abound in building construction sites and efforts at prevention and control are at best poor and ineffective. There is need for institution of safety standards with training of workers on hazards they are likely to confront as they ply their trade.

**KEYWORDS:** Hazards, construction, building

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## INTRODUCTION

An Accident is a logical consequence for not instituting and practicing safety while on and off work. According to International Labor Organization (ILO), an occupational accident is an unexpected and unplanned occurrence, including acts of violence, arising out of or in connection with work which results in one or more workers incurring a personal injury, disease or death[1]. An accident is a casualty or an unforeseen event characterized by sudden and external force or violence, it is an unfortunate happening, that leads to personal injury, death and damages to or loss of property. It is a blind chance happening. Site accident sometimes happens because of complete mistakes or lack of awareness on the part of the workers[2]. Accidents resulting from lack of awareness occur mostly in specialized or disciplined operations. Other causes of accidents in the construction sites include indiscipline, inadequate communications and site characteristics. The fault of accident lies with the system, environment and person involved in the construction[3,4]. Construction is one of the world's biggest industries with jobs as diverse as

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building, civil engineering, demolition, renovation, repair and maintenance. It accounts for a large proportion of Gross Domestic Product i.e. 10% in the U.K. and 17% in Japan. Despite improvement in safety management, fatalities are still frequent[5-8]. Construction workers are exposed to a wide variety of hazards on the job. All around the world, at least 108,000 workers are killed on sites every year; this figure represents about 30% of all fatal occupational injuries[9,10].

Construction workers normally build, repair, maintain, modify and renovate buildings. According to ILO, the construction industry is considered as government and private sector firms that erect buildings for various purposes[11]. Hence, the workers especially the unskilled ones (the masons) have little or no awareness of the health and safety hazards that are affecting them every day in their place of work. Nowadays, female workers are also present at the construction sites and are at a higher risk of accident and illness than their male counterparts[12,13].

The number of workers in the construction industry represents about 10% of all workers. However, the industry accounts for nearly 40% of all fatal industrial accidents, over 20% of accidents with injuries requiring absence for four or more days and about 40% of serious accidents that result in three or more deaths or injuries[14-17]. Occupational accidents in the construction industry occur more frequently on sites where a small or medium-sized general contractor is the principal contractor than on sites where a major general contractor is the principal contractor. By type of accident, falls account for about 40% of fatal accidents, and accidents involving construction machinery account for over 10% of fatal accidents[18,19].

Construction industry is unarguably the base for social and economic development in all countries of the world. Its position in economy of any nation cannot be over emphasized. Though in the first quarter of 2012, the building and construction industry contributed 3.01% of the total Gross Domestic Product (GDP) to the Nigerian economy and its importance and roles in the development of economy of Nigeria and that of other nations can not be over emphasized[20]. However, when compared with other labor intensive industries, construction industry has historically experienced a disproportionately high rate of disability injuries and fatalities for its size. The industry alone produces 30% of all fatal industrial accidents across the European Union (EU), yet it employs only 10% of the working population[21]. In The United States of America (USA), it accounts for 22% of all fatal accidents and only 7% of the employed, notes that in Japan, construction accidents account for 30%-40% of the overall industrial accidents, with the total being 50% in Ireland and 25% in the United Kingdom (UK). This situation is even worse in the developing countries and Nigeria in particular, because there are no reliable sources of data for such accident records[22].

In developing countries, construction industry has performed far below the expectation in the areas of health and safety. The situation is quite pathetic in Nigeria because there is no existing functional legislation to that effect. Even the National Building Code which was approved by the National Executive Council since 2006 and the enforcement Bill currently before the National Assembly has not been passed into law till date. Based on these, it had been argued that the framework of existing occupational and health conditions of Nigeria construction industry is grossly fragmented and inadequately enforced[23]. From the present situation, accidents on construction sites results to many human tragedies de-motivate workers, disrupt site activities, delay project progress, and adversely affect the overall cost, productivity and reputation of the construction industry. In recognition of the problems above, countries all over the world have seen the necessity of improving occupational health and safety management on construction sites, particularly, the reduction of the number of accidents on construction sites[24,25]. The main causes of accidents in the construction sector include: Slips, trips and low falls- These are probably the most common form of accident in construction. Although usually minor, they can lead to many different injuries and ill health outcomes, from musculoskeletal disorders (e.g. strained ankle) to puncture wounds (from falling on sharp materials). Fatalities from apparently innocuous slips have been known. Falls from height- This is the main cause of fatal accidents. These often occur due to: Inadequate scaffolding, Lack of edge protection, unprotected openings in buildings, Lack of edge protection in roof work, Dangerous demolition work, and inappropriate use of inappropriate ladders and hoists. Crush injuries- These occur in unsafe excavations often lead to fatal accidents or serious injuries. They occur when there is inadequate support for trench sides, especially after rainfalls, or when vehicles are operating too close to the edge. Buildings and walls may collapse when supporting structures are undermined. Being struck by falling objects, materials or tools[25]- This is a potentially deadly occurrence. Such falling objects can be due to: The lack of toe boards on scaffolding, Lack of tool belts for workers, Bad storage and stacking, and Poor housekeeping. Injuries may also result from improper use of hoists and cranes, and from being struck, crushed or trapped by vehicles, trucks and machinery. Electrocutions- This can be due to cable strikes on buried services, or to contact with overhead cables[26].

There are many types of construction accidents, and they can be classified by different categories. In terms of severity, a construction accident may or may not cause injuries and life loss, and the economic loss may be small or huge. A construction accident can be rooted in equipment failure, design ignorance, working carelessness, and natural disasters, etc. In addition, based on the locations, there are tunnel accidents, highway construction accidents, and residential building site accidents etc[27,28] This study was to assess the pattern of accidents at building construction sites in Obio-Akpor Local Government Area of Rivers State, Nigeria.

## MATERIALS AND METHODS

**Study Area:** Obio-Akpor is one of the two Local Government Areas (LGAs) making up the Port Harcourt metropolis of Rivers State and a major hob of economic activities in Nigeria. The Local Government Area covers 260 $km^2$ and at the 2006 Census held a population of 878,890. Obio/Akpor with headquarters at Rumuodomaya is indigenously inhabited by the Ikwerres but is an amalgam of multi-ethnic, multi-national and multi-cultural array of dwellers. The major occupation of the people are farming, fishing and trading. However, there is a wide range of other commercial ventures. Construction of especially houses is actively going on in almost all undeveloped areas of the LGA.

**Study Population:** This included individuals working at participating construction site, cutting across diverse fields e.g. bricklayers, carpenters, plumbers' etc. with age range of 18-60years and also a range illiterate, semi-literate to literate individuals. The workers worked between 9am-4pm Monday through Saturday.

**Study Design & sampling:** This descriptive cross-sectional study recruited a calculated sample of 402 consenting adults who had worked in constructing sites for at least 2 years**.** Using a multi-stage sampling, Obio-Akpor Local Government Area (Appendix B) was divided into four quadrants to form clusters, ten construction sites was randomly selected from the communities within each cluster. Thereafter, ten workers were each selected from each of the selected construction sites. It is noteworthy that there was more construction taking place south of the LGA compared to the north. This is because, up north is the old Port Harcourt city and is fully developed.

**Study Instruments:** This included a **questionnaire** – structured, close ended interviewer and self administered probing socio-demographics, occupational history, knowledge and behavior towards hazards in work place. The questionnaire was pre-tested among semi-skilled personnel i.e. mechanics and necessary adjustments made subsequently. Then the **Walk through survey** which described the site, identified and quantified hazards, risk assessment, requisite investigation and the report. This was done using an adapted standard checklist

**Data Management:** Applying the inclusion criteria, two trained assistants with the researchers administered the questionnaires on the consenting respondents according to their level of literacy. This was done through 4 weeks during break period i.e. 1pm daily Monday through Saturday. Data was then entered into an Excel work sheet and analysed with Statistical Package for Social Sciences (SPSS) with descriptive and analytical statistical methods. Data were then presented in tables and figures.

**Ethical Consideration:** Ethical clearance to conduct the study was obtained from the Ethical and Scientific Committee of the School of Graduate Studies, University of Port-Harcourt. Every participant in the project was informed adequately about the nature, extent, and purpose of the research. They later signed a consent form. There was also Health Education on prevention and control of hazards encountered on work site would be done after completing the questionnaires.

## RESULT

TABLE 1: Socio-Demographics of Respondents

| Variable | Frequency (n) | Perc. (%) |
|---|---|---|
| **Age (yrs)** | | |
| 18-25 | 95 | 23.75 |
| 26-35 | 218 | 54.5 |
| 36-45 | 70 | 17.5 |
| 46-55 | 13 | 3.25 |
| Over 55 | 4 | 1.0 |
| ***TOTAL*** | ***400*** | ***100.0*** |
| **Sex** | | |
| Male | 366 | 91.50 |
| Female | 34 | 8.50 |
| ***TOTAL*** | ***400*** | ***100.0*** |
| **Educational Level** | | |
| Primary | 45 | 11.25 |
| Secondary | 252 | 63.0 |
| Tertiary | 96 | 24.0 |
| None | 7 | 1.75 |
| ***TOTAL*** | ***400*** | ***100.0*** |
| **Marital status** | | |
| Single | 185 | 46.25 |
| Married | 215 | 53.75 |
| Divorced | 0 | 0.0 |
| ***TOTAL*** | ***400*** | ***100.0*** |
| **Religion** | | |
| Christianity | 312 | 78.0 |
| Islam | 83 | 20.75 |
| Traditional worshipper | 5 | 1.25 |
| ***TOTAL*** | ***400*** | ***100.0*** |

TABLE 2: Respondents Occupational History

| Variable | Freq. (n) | Perc. (%) |
|---|---|---|
| **Any previous job before this one** | | |
| Yes | 144 | 36.0 |
| No | 256 | 64.0 |
| ***TOTAL*** | ***400*** | ***100.0*** |
| **Specification of other Jobs(n=144)** | | |
| store keeper | 1 | 0.69 |
| Accountant | 1 | 0.69 |
| Butcher | 2 | 1.39 |
| c & i | 2 | 1.39 |
| Carpentry | 7 | 4.86 |
| computer operator | 2 | 1.39 |
| concrete mixer operator | 1 | 0.69 |
| Construction | 6 | 4.17 |
| cooking | 1 | 0.69 |
| Driver | 14 | 9.72 |
| Electrician | 1 | 0.69 |
| electronic security | 1 | 0.69 |
| estate firm | 1 | 0.69 |
| Farming | 1 | 0.69 |
| fast food (caterer) | 1 | 0.69 |
| Hospital | 2 | 1.39 |
| iron bender | 1 | 0.69 |
| Laborer | 8 | 5.56 |
| Legislative | 1 | 0.69 |
| Masonry | 5 | 3.47 |
| Marketing | 1 | 0.69 |
| Mechanic | 7 | 4.86 |
| office assistant | 1 | 0.69 |
| oil & gas | 1 | 0.69 |
| Machine operator | 6 | 4.17 |
| Plumber | 2 | 1.39 |
| print press | 1 | 0.69 |
| Production | 2 | 1.39 |
| project engineer | 1 | 0.69 |
| QA/QC supervisor | 4 | 2.78 |
| Security | 2 | 1.39 |
| site engineer | 7 | 4.86 |
| store keeper | 1 | 0.69 |
| Teacher | 6 | 4.17 |
| Technician | 1 | 0.69 |
| Tiller | 1 | 0.69 |

TABLE 3: Respondents' Knowledge of hazards

| Variable | Freq (n) | Perc (%) |
|---|---|---|
| **Knowledge that present Job can expose them to Hazard** | | |
| Yes | 372 | 93.0 |
| No | 28 | 7.0 |
| ***TOTAL*** | ***400*** | ***100.0*** |
| **Knowledge on if these Hazards can be prevented (n=372)** | | |
| Yes | 316 | 84.95 |
| No | 39 | 10.48 |
| No response | 17 | 4.57 |
| **Knowledge on if wearing PPE can protect from Hazard (n=372)** | | |
| Yes | 321 | 86.29 |
| No | 45 | 12.10 |
| No Response | 6 | 1.61 |
| **Some PPE known (Multiple responses)** | | |
| Harness belt | 4 | 0.85 |
| Coverall | 72 | 15.22 |
| Ear muff | 14 | 2.96 |
| Eye goggle | 69 | 14.59 |
| Face mask | 1 | 0.21 |
| Hand glove | 83 | 17.55 |
| Helmet | 56 | 11.84 |
| Insulator | 3 | 0.63 |
| Nose mask | 63 | 13.32 |
| Rain boot | 11 | 2.33 |
| Raincoat | 2 | 0.42 |
| Safety boot | 95 | 20.08 |
| ***TOTAL*** | ***473*** | ***100.0*** |

TABLE 4: Attitude to Safety

| Variable | Frequency (n) | Percentage (%) |
|---|---|---|
| **Any safety talk/training before starting work on site** | | |
| Yes | 298 | 74.50 |
| No | 91 | 22.75 |
| No response | 11 | 2.75 |
| ***TOTAL*** | ***400*** | ***100.0*** |
| **Do you work in extreme temperature** | | |
| Yes | 214 | 53.50 |
| No | 164 | 41.0 |
| No response | 22 | 5.50 |
| ***TOTAL*** | ***400*** | ***100.0*** |
| **Has there been use of General protective equipment** | | |
| Yes | 59 | 14.75 |
| No | 341 | 85.75 |
| ***TOTAL*** | ***400*** | ***100.0*** |
| **Has there been use of Personal protective equipment** | | |
| Yes | 188 | 47.0 |
| No | 212 | 53.0 |
| ***TOTAL*** | ***400*** | ***100.0*** |
| **Has there been use of both General protective equipment and Personal protective equipment** | | |
| Yes | 122 | 30.50 |
| No | 278 | 69.50 |
| ***TOTAL*** | ***400*** | ***100.0*** |
| **Type of protective equipment used (Multiple responses)** | | |
| Coverall | 60 | 24.19 |

| | | |
|---|---|---|
| dust mask | 1 | 0.40 |
| ear muff | 8 | 3.23 |
| eye goggle | 19 | 7.66 |
| hand glove | 35 | 14.11 |
| harness belt | 3 | 1.21 |
| Helmet | 46 | 18.55 |
| nose mask | 11 | 4.44 |
| rain boot | 7 | 2.82 |
| Raincoat | 1 | 0.40 |
| safe office environment | 2 | 0.81 |
| safety apron | 1 | 0.40 |
| safety belt | 4 | 1.61 |
| safety boot | 50 | 20.16 |
| ***TOTAL*** | ***248*** | ***100.0*** |

TABLE 5: Respondents' Practice of safety

| Variable | Frequency (n) | Percentage (%) |
|---|---|---|
| **Been involved in any form of accident on site** | | |
| Yes | 143 | 35.75 |
| No | 257 | 64.25 |
| ***TOTAL*** | ***400*** | ***100.0*** |
| **Type of accident involved in (n=143)** | | |
| Slips, trips and low falls | 60 | 41.96 |
| Fall from height | 51 | 35.66 |
| Electrocutions and power tool accidents | 22 | 15.38 |
| Construction vehicle accidents | 10 | 6.99 |
| | | |
| **Form of Injury or ill health that resulted (n=143)** | | |
| Musculoskeletal disorders | 67 | 46.85 |
| Puncture wounds | 47 | 32.87 |
| Electrocutions | 12 | 8.39 |
| Disability | 0 | 0.0 |
| No response | 17 | 11.89 |
| | | |
| **If accident was reported (n=143)** | | |
| Yes | 97 | 67.83 |
| No | 39 | 27.27 |
| No response | 7 | 4.90 |
| | | |
| **If absent from work as a result of accident (n=143)** | | |
| Yes | 60 | 41.95 |
| No | 76 | 53.15 |
| No response | 7 | 4.8 |
| **Number of days absent from work (n=60)** | | |
| 1-4 days | 17 | 28.33 |
| 5-8 days | 11 | 18.33 |
| More than 8 days | 32 | 53.33 |

TABLE 6: Hazards related to Construction Company as adduced by respondents

| Variables | Frequency (n) | Percentage (%) |
|---|---|---|
| **Physical Hazard (Multiple responses)** | | |
| Noise | 275 | 31.46 |
| Heat | 223 | 25.51 |
| Cold | 158 | 18.08 |
| Flame/Fire | 218 | 24.94 |
| ***TOTAL*** | ***874*** | ***100.0*** |
| **Mechanical (Multiple responses)** | | |
| Falling off from the ladder or height | 270 | 29.25 |
| Slips, trips and low fall | 268 | 29.04 |
| Struck by falling objects | 177 | 19.18 |
| Puncture wounds | 208 | 22.54 |
| ***TOTAL*** | ***923*** | ***100.0*** |
| **Chemical (Multiple responses)** | | |
| Dust | 243 | 24.39 |
| Fumes | 161 | 16.16 |
| Gases or vapors | 172 | 17.27 |
| Toxic or corrosive products | 156 | 15.66 |
| Acid | 155 | 15.56 |
| Solvent | 109 | 10.94 |
| ***TOTAL*** | ***996*** | ***100.0*** |
| **Biological (Multiple responses)** | | |
| Skin diseases | 231 | 44.94 |
| Respiratory diseases | 178 | 34.82 |
| Dermatitis | 104 | 20.23 |
| ***TOTAL*** | ***514*** | ***100.0*** |

TABLE 7: Prevention and Control

| Variable | Frequency (n) | Percentage (%) |
|---|---|---|
| **Do you think that accidents can be prevented on site by giving safety training before starting work?** | | |
| Yes | 330 | 82.50 |
| No | 54 | 13.50 |
| No response | 16 | 4.0 |
| ***TOTAL*** | ***400*** | ***100.0*** |
| **Will the use of GPE and PPE prevents accidents from occurring?** | | |
| Yes | 299 | 74.75 |
| No | 83 | 20.75 |
| No response | 18 | 4.5 |
| ***TOTAL*** | ***400*** | ***100.0*** |
| **Are you comfortable with the use of protective equipment?** | | |
| Yes | 333 | 83.25 |
| No | 49 | 12.25 |
| No response | 18 | 4.5 |
| ***TOTAL*** | ***400*** | ***100.0*** |
| **When accidents occur on site, was it reported and investigated?** | | |
| Yes | 306 | 76.50 |
| No | 62 | 15.50 |
| No response | 32 | 8.0 |
| ***TOTAL*** | ***400*** | ***100.0*** |
| **Do you think observing an hour for break and resting time can prevent accident from occurring** | | |
| Yes | 285 | 71.25 |
| No | 72 | 6.75 |
| No response | 43 | 3.75 |
| ***TOTAL*** | ***400*** | ***100.0*** |
| **Will giving of safety talk be helpful in the prevention of accidents on site?** | | |
| Yes | 358 | 89.50 |
| No | 27 | 6.75 |
| No response | 15 | 3.75 |
| ***TOTAL*** | ***400*** | ***100.0*** |
| **Will re-training of workers on site be helpful in the prevention of accidents** | | |
| Yes | 313 | 78.25 |
| No | 71 | 17.50 |
| No response | 16 | 4.0 |
| ***TOTAL*** | ***400*** | ***100.0*** |

**REPORT OF WALKTHROUGH SURVEY**

This particular report was essentially a general reflection of work sites visited by the team. Visits were at all times an impromptu, unannounced visit.

- **Description of site**-The site is a residential storey building, located at Chief Eke Street, Gbalajam, Circular road, Woji. It has a work force of about 10 workers as at the time of this survey, which includes Site Engineer, bricklayers, fitters, fabricator (Material: Aluminum).
  The processes that were surveyed included the plastering of the walls with cement, the fitting of the windows and doors, fabrication of window fittings, mixing of cements and sand.
- **Hazard identification**
  * Physical hazard: The workers are exposed to Noise from hammering, generator and machines. The Aluminum Fabricator was exposed to Vibration of his hands and arms from the use of the machine, the workers were also exposed to Air pollution.
  * Chemical hazard: The workers are exposed to Dust from the cement mixing and plastering, also fumes from the generator, the Aluminum fabricator was exposed to the Aluminum particles produced from the machine.
  * Mechanical hazard: There was poor housekeeping, which could expose the workers to falls, slips and trips.
  * Biological hazard: The workers could be exposed to viruses, fungi and bacteria resulting to respiratory and skin diseases e.t.c. Some workers are resident within the uncompleted building and could be exposed to mosquito bites.
  * Social hazard: This consists of man-man interface, worker-worker compatibility or relationship, boss subordinate relationship, personal lifestyle such as drinking, malingering and bullying.
- **Risk assessment**: Most of the workers were not wearing any personal protective equipment. One of the bricklayers plastering the outside of the storey building, stood on a single piece of wood, placed on two holes within the building, the Aluminum fabricator was working with the machine, which was vibrating his hands and arms without wearing gloves, no use of face mask, following production of Aluminum particles, and mixing of cement, A power generating set was on inside the building to power the fabricator machine just as other workers were working in the same building with the attendant noise and air pollution.
- **Impression**- The workers were health educated on the importance of wearing their PPE to prevent the occurrence of accident on site and further health challenges.
  - Use of ear muffs or plugs and face mask to reduce exposure to noise and air pollution.
  - The Aluminum fabricator should use a hand glove to reduce the effect of vibration of his hands and arms, and also face mask to reduce inhalation of the Aluminum particles.
  - The workers mixing cement and plastering can also benefit from the use of hand gloves and face mask to prevent skin diseases and irritation.
  - Good and proper scaffolding should be employed and not improvising at the expense of your health.
  - There should be proper supervision and enforcement of the use of PPE such as hard hat and safety boot to prevent falling objects, falls, slips and trips.
  - Good housekeeping would be beneficial to all workers, hence preventing the commonest form of accidents i.e. slips, trips and low falls.
  - The generator set should be powered outside the building to reduce noise and air pollution.

## DISCUSSION

Accident even in the construction of buildings may be due to equipment failure, bad design, work site ignorance, work site carelessness, natural disasters, etc. Also, based on the locations, there are tunnel accidents, highway construction accidents, and residential building site accidents, to name but a few. From Table 1, the study recruited 400 construction workers, 366 males and 34 females underscoring that this endeavour is yet a male dominated one at least in Rivers State. According to the International Labour Organization, ILO, females are increasingly seen at construction sites and may be at higher risk for illnesses and even accident than their male counterparts. From the study, 218 (54.5%) of the workers were within the youthful age of 26-35years, and 252 (63%) had secondary school education, while 7 (1.75%) scarcely had any form of education. These figures are in keeping with the ILO position that a large portion of construction workers are unskilled and poorly.

Construction of buildings is one of the world's biggest and diverse industries with jobs ranging from building, civil engineering, demolition, renovation, repair and maintenance etc. From Tables 2 and 3; The top 10 category of workers enrolled for this study includes Mason 40 (10%), site carpenter 33 (8.25%), welder 26 (6.5%), laborer 24 (6.0%), building & civil engineers 18 (4.5%), plumber 15 (3.75%), tiller, painter, electrician 14

(3.5%), industrial training 13 (3.25%), truck driver 10(2.5%), supervisor, first aid 7 (1.75%). 47 (11.75%) did not indicate their job description on site. Experience at work ranged from 71 (17.75%) of the workers had an experience of 5-6 years, 50 (12.5%) had an experience of 11years and above, 26 (6.5%) had an experience of less than a year.

Research has shown that there appears to be a general high accident rate in construction sites needing urgent attention (Poon et al. 2008). However, in the last decade there has been a downward trend in construction accidents in most industrialized places as a result of due implementation of appropriate safety schemes. This has also been replicated to a good extent among the construction workers in this study as 64.25% of respondents had not been involved in any form of accident on site as compared. This finding as good as it may be, does not in anyway diminish the dire need for workers to maintain and improve on safety practices in and even out of the construction sites. .

Also, 278 (69.50%) of the workers agreed to being exposed to hazards at the work place how ILO records show that workers especially unskilled (i.e. masons etc) have little (if any) awareness of the health and safety hazards they may be facing at their work place. Construction workers in this study are exposed to a lot of hazards on site. The hazards in order of prevalence includes noise (31.46%), falling off from the ladder or height (29.25%), slips, trips and low falls(29.04%), dust(24.39%), heat(25.51%), flame/fire(24.94%), puncture wound(22.54%), struck by falling objects(19.18%), gases or vapors(17.27%), fumes(16.16%), cold(18.08) e.t.c. Al-Rubaee and Al-Maniri showed that fall (11.8%) was the second most common cause of occupational injuries in Oman. A recent study from Qatar, reported falls to be the second most common cause of traumatic brain injury (TBI) among young workers (94%). Working in exceptionally high-rise buildings and extremes of temperature contributed significantly to the risk of falls. These problems may be averted if construction hazards are identified and eliminated at the incipient stage through changing the work environment/safety culture via a construction site safety audit (Reason, 1990). Noise has not been reported in previous studies sites just as Injuries sustained in this study include musculoskeletal (46.85%), Puncture wounds (32.87%), Electrocutions (8.39%).

Awareness of safety measures among these construction workers was good because 84.95% of the workers were aware that the hazards they encounter are preventable, 86.29% believe that the use of personal protective equipment is helpful in protecting from hazards.

Other findings from this study include 83.25% are comfortable with the use of personal protective equipments, 71.25% were of the opinion that observing an hour for break and resting time can prevent accident from occurring just as 78.25% agree that regular training of workers on site would be helpful in the prevention of accidents. This is in with studies in the United Arab Emirates where poor awareness and practice of safety were associated with fatal and non fatal injuries at construction sites.In Nigeria, the first effort in regulating and controlling Health and Safety at work was the Factories Act of 1958, but unfortunately enforcement has been poor. The Labour Decree does not provide workers with the right to remove themselves from dangerous work situations without running the risk of losing their job (Nigerian Factories Act, 2002).

## CONCLUSION

Accidents do not happen, they are caused. They are caused because someone did something he should not have done or somebody failed to do something he should have done. Carelessness, indifference and negligence are responsible for one out of three accidents.' Most of the workers were aware that their job can expose them to a wide range of hazards and most of them know that the use of personal protective equipments can protect them. However, use of personal protective was poor.

## RECOMMENDATIONS

There is need for setting up and enforcement of standards for building construction sites. Construction workers need to be trained and certified on Health and Safety. There also be enforced use of personal protective equipment and reportage of work place accidents.

## APPENDIX A: CONSTRUCTION SAFETY CHECKLIST FOR WALK THROUGH

**1. Personal Protective Equipment:**

Safety glasses, hard hats and work boots are required 100% of the time while working within the designated construction area on any construction or facilities maintenance project. High visibility safety vests are required on most construction sites.

Additional task-specific PPE will be required based on the answers below:

| **1a Identify the PPE that you will require based on the hazards of the tasks to be performed:** | | |
|---|---|---|
| Full Face Shields | YES ☐ | NO ☐ |
| Chemical Splash Goggles | YES ☐ | NO ☐ |
| Welders Hood and Goggles, Leathers Gloves | YES ☐ | NO ☐ |
| Steel Toed Boots, | YES ☐ | NO ☐ |
| Work Gloves | YES ☐ | NO ☐ |
| Ear plugs Or Ear Muffs | YES ☐ | NO ☐ |
| Other (describe) | YES ☐ | NO ☐ |

| **1a Identify Specialty PPE** | | | | |
|---|---|---|---|---|
| Fall Protection: Active or passive fall protection is required any time the worker is either above 4 feet (maintenance work) or above 6 feet (construction work). | | | NA ☐ | |
| Subcontractor will submit the following documentation for fall protection: | | | YES ☐ | NO ☐ |
| - Fall Protection Work Plan (such as an LBNL fall protection matrix) | | | YES ☐ | NO ☐ |
| - Training Records | | | | |
| Electrical PPE: | | | NA ☐ | |
| Identify electrical PPE to be worn. | | | | |
| Head protection (ANSI Z89.1, 1997) | | | YES ☐ | NO ☐ |
| Eye & Face (ANSI Z87.1, 1998) | | | YES ☐ | NO ☐ |
| Rubber-Insulating Gloves (ASTM D120-02, 2002) | Class: | | YES ☐ | NO ☐ |
| | Class: | | YES ☐ | NO ☐ |
| Rubber-Insulating Sleeves (ASTM D 1051-02, 2002) | Class: | | YES ☐ | NO ☐ |
| | Class: | | YES ☐ | NO ☐ |
| Leather Protectors (ASTM F 696-02, 2002) | Cal. | | YES ☐ | NO ☐ |
| Dielectric Footwear (ASTM F 1117-98, 1998) | Rating: | | YES ☐ | NO ☐ |
| Flame Resistant (FR) Clothing (ASTM F 1506-02a) | Cal. | | YES ☐ | NO ☐ |
| | Rating: | | | |
| FR Face Protection Products (ASTM F 2178-02) | Cal. | | | |
| FR Outerwear (Raingear, etc.) (ASTM F 1891-02a) | Rating: | | | |
| Respiratory Protection: | | | NA ☐ | |
| Subcontractor will submit the following documentation for respirator use: | | | YES ☐ | NO ☐ |
| - Respiratory Protection Plan: | | | YES ☐ | NO ☐ |
| - Medical Surveillance Release (remove/blacken out personal information): | | | YES ☐ | NO ☐ |
| - Quantitative Fit Test Records: | | | YES ☐ | NO ☐ |
| - Qualitative Fit Test Records: | | | | |
| - Training Records: | | | | |

2. **Hand and Power Tools** **NA** ☐

| | | |
|---|---|---|
| Will the work involve the use of electrically powered tools? | YES ☐ | NO ☐ |
| Will the work involve the use of pneumatically powered tools? | YES ☐ | NO ☐ |
| Will the work performed on this project involve the use of powder-actuated tools? | YES ☐ | NO ☐ |
| Subcontractor will submit the following items for Powder Actuated tools:<br>- Training Records: | YES ☐ | NO ☐ |

**3. Ground & Surface Penetrations**

**NA** ☐

| | | |
|---|---|---|
| Will the work scope require you to cut into, chip into, drill into, or make any other penetrations into walls, ceilings or floors deeper than 1 5/8”? | YES ☐ | NO ☐ |
| Will the work scope require you to excavate, trench, dig, or otherwise penetrate into the ground (including use of stakes or poles) deeper then 1 5/8”? | YES ☐ | NO ☐ |
| Will the work scope require you to penetrate into any concrete surface at any depth? | YES ☐ | NO ☐ |
| Have building surfaces or structures to be penetrated been evaluated for lead and asbestos? | YES ☐ | NO ☐ |

4. **Excavation and Trenching** **NA** ☐

| | | |
|---|---|---|
| Will this work scope involve any excavation up to 5 feet deep? | YES ☐ | NO ☐ |
| Will this work scope involve any excavation deeper than 5 feet? | YES ☐ | NO ☐ |
| Will this work scope involve sanitary sewer line repair or replacement? | YES ☐ | NO ☐ |
| Will this work scope involve storm sewer line repair or replacement? | YES ☐ | NO ☐ |
| Subcontractor will submit the following items for Excavation and Trenching: | YES ☐ | NO ☐ |
| - JHA detailing Shoring Plan | YES ☐ | NO ☐ |
| - Training Records | | |

5. **Demolition** **NA** ☐

| | | |
|---|---|---|
| The subcontractor has signed off on the Isolation Plan: Electrical, Gas, Water, Steam, or other Utilities? | YES ☐ | NO ☐ |
| Subcontractor will submit the following items for Demolition Plan:<br>- An Isolation Plan along with a SOP for startup. | YES ☐ | NO ☐ |

6. **Elevated Work Surfaces** (aerial / scissors lifts, scaffolds or Ladders) **NA** ☐

| Identify what will be used on this project below: | | |
|---|---|---|
| **Elevated Work Platforms** | | |
| Aerial Lift | YES ☐ | NO ☐ |
| Articulating Boom Lift | YES ☐ | NO ☐ |
| Scissor Lift | YES ☐ | NO ☐ |
| Man-Lift | YES ☐ | NO ☐ |
| Other (identify) | YES ☐ | NO ☐ |
| Subcontractor will submit the following items for aerial and platform lifts:<br>- Training Records for each person operating lift. | YES ☐ | NO ☐ |
| **Scaffolding** | | |
| Tubular & Coupler Scaffolding | YES ☐ | NO ☐ |
| Rolling Scaffold | YES ☐ | NO ☐ |
| Mobile Scaffold | YES ☐ | NO ☐ |
| Mason/Bricklayers Scaffold | YES ☐ | NO ☐ |
| Other (describe): | YES ☐ | NO ☐ |
| Subcontractor will submit the following items for scaffold use: | | |
| - Training records for each person erecting and disassembling scaffold. | YES ☐ | NO ☐ |
| - A written fall protection plan (such as the LBNL fall protection matrix) | YES ☐ | NO ☐ |
| - Training records for users of fall protection | YES ☐ | NO ☐ |
| - Training records for scaffold users | YES ☐ | NO ☐ |
| Identify ladders that will be used on this project below: | | |
| 6' or smaller A-Frame or Platform Ladder | YES ☐ | NO ☐ |
| 6' to 12' A-Frame or Platform Ladder. | YES ☐ | NO ☐ |
| 12' or greater A-Frame or Platform Ladder. | YES ☐ | NO ☐ |
| Extension Ladder less than 24' | YES ☐ | NO ☐ |
| Extension Ladder over 24' | YES ☐ | NO ☐ |
| Subcontractor will use for ladders if working above 6' without maintaining 3 points of contact or using a platform ladder:<br>- Fall protection Matrix (to be filled out by LBNL competent person) | YES ☐ | NO ☐ |

7. **Cranes & Heavy Equipment** **NA** ☐

| Identify cranes or heavy equipment that will be used on this project below: | | |
|---|---|---|
| Backhoe | YES ☐ | NO ☐ |
| Front End Loader | YES ☐ | NO ☐ |
| Excavator | YES ☐ | NO ☐ |
| Crane Under 3 Tons | YES ☐ | NO ☐ |
| Crane Over 3 Tons | YES ☐ | NO ☐ |
| Forklift | YES ☐ | NO ☐ |
| Other (identify) | YES ☐ | NO ☐ |
| Subcontractor will submit the following items for crane or heavy equipment: | YES ☐ | NO ☐ |
| - Crane current annual inspection certification: | YES ☐ | NO ☐ |
| - Crane quadrennial proof load test certification: | YES ☐ | NO ☐ |
| - Crane operator's license: | YES ☐ | NO ☐ |
| - Backhoe, Front End Loader, Excavator proof of competency | YES ☐ | NO ☐ |
| - Forklift operator certification/license: | | |

8. **Fire Protection & Prevention** **NA** ☐

| | | |
|---|---|---|
| Will work include the use of open flames such as torches, welders, grinders, tar pots or any other tool or process/procedure that could cause sparks or open flames? | YES ☐ | NO ☐ |
| Will work be performed near combustible storage containers? | YES ☐ | NO ☐ |
| Will there be on-site refueling of equipment? | YES ☐ | NO ☐ |
| Has a Fire Watch been training in the use of fire extinguisher and emergency procedures for the work being performed? | YES ☐ | NO ☐ |
| Subcontractor will submit for hot work activities:<br>- LBNL Hot Work Permit | YES ☐ | NO ☐ |

9. **Roofers / Non-Roofers** (working near other leading edges) **NA** ☐

| | | |
|---|---|---|
| Will roof installation or roof repairs be performed?<br>Will you be on any roof performing work in your specific trade? | YES ☐<br>YES ☐ | NO ☐<br>NO ☐ |
| Are you a roofer?<br>Non-roofer? | YES ☐<br>YES ☐ | NO<br>☐<br>NO<br>☐ |
| For Roofers<br>Contractor will submit the following items for Roofing Work:<br>- A fall protection work plan indicating the fall protection system to be used for roofing work 6' or more above lower levels and 6' from an unprotected edge. (per ANSI/ASSE Z359)<br>- Training Records for all person working on the roof | YES ☐<br>YES ☐ | NO ☐<br>NO ☐ |
| For Non-Roofers<br>Contractors will submit the following items for working on roofs:<br>-A "Roof Work Plan" which is a diagram & written direction on how the roof<br>fall protection system shall be set up & maintained<br>-Fall Protection Matrix (filled out by LBNL)<br>-Fall Protection Training<br>Will employees remain 15 feet back from the roof or other leading edge greater than 6 feet in height?<br>Will a warning line system (non-conforming guardrail) be used to delineate the 15 foot boundary?<br>Will work take place beyond the warning line?<br>- All contractors working on roof shall submit a Roof Work Plan. This will include a diagram & written direction on how the roof fall<br>protection shall be set up & maintained<br>- Fall protection matrix is required (filled out by LBNL)<br>- Training Records | YES ☐<br>YES ☐<br>YES ☐<br>YES ☐<br>YES ☐ | NO ☐<br>NO ☐<br>NO ☐<br>NO ☐<br>NO ☐ |

**10.** Hazardous Substances or Materials NA ☐

Certain existing building components or materials that may be impacted by the work of this project are known or presumed to contain hazardous materials including, but not limited to, asbestos and lead. Comply with the applicable abatement sections and safety requirements of the contract documents. Should the contractor(s) or subcontractor(s) determine or believe that any building component or material, not already noted as containing a hazardous material, contains asbestos, lead, or other hazardous material, they shall notify LBNL immediately. Common building materials that contain asbestos at LBNL include floor tile and mastic, sheetrock and taping compound, pipe insulation, fire doors, and transite. Paint surfaces and settled dust commonly contain lead. Prior to disturbing building materials check with LBNL to evaluate the hazard and prescribe controls.

Construction materials that contain hazardous materials such as asbestos, lead, and mercury must be approved by Facilities Construction Management prior to installing.

*Per DOE's Worker Protection Rule (10 CFR 851), the subcontractor is required to perform their own exposure assessments for hazardous materials.*

| | | |
|---|---|---|
| Will the work involve the use of any chemicals, such as paints, solvents, adhesives, epoxy coatings, fuels or other hazardous materials? | YES ☐ | NO ☐ |
| Are all personnel using these materials trained in safe handling? | YES ☐ | NO ☐ |
| Will there be an emergency eyewash and shower in the immediate work area at a location that can be reached by a blinded worker in an uncomplicated and unimpeded path within 10 seconds travel time (approximately 50 feet)?<br>If "NO", a portable eyewash station, capable of providing 15 minutes of continuous water flow, shall be provided (handheld squeeze bottle type is not allowed) that meets the same access requirement listed above? | YES ☐ | NO ☐ |
| Will employees be potentially exposed to airborne concentrations of hazardous gas, fume, dust or mist? | YES ☐ | NO ☐ |
| Will MSDS(s) be available to the workers onsite? | YES ☐ | NO ☐ |
| Will respirators be required? | YES ☐ | NO ☐ |
| Describe the type of respiratory protection to be used: | | |

11. **Asbestos** **NA** ☐

| | | |
|---|---|---|
| Will the work require asbestos removal or disturbance? | YES ☐ | NO ☐ |
| Will the work require a 10 day notification to (BAAQMD) for renovations involving RACM greater than or equal to 100 linear feet 100 sq ft, or 35 cu ft prior to renovations? | YES ☐ | NO ☐ |
| Subcontractor will submit the following items for asbestos removal: | | |
| - BAAQMD renovation/demolition forms prior to sending to the BAAQMD for review by LBNL EH&S Environmental Services | YES ☐ | NO ☐ |
| - Site Specific Asbestos Compliance Plan | YES ☐ | NO ☐ |
| - JHA addressing asbestos hazards | YES ☐ | NO ☐ |
| - Respiratory Protection Program | YES ☐ | NO ☐ |
| - Subcontractor's Asbestos Program | YES ☐ | NO ☐ |
| - AHERA Asbestos Worker Training Certificates | YES ☐ | NO ☐ |
| - Medical approvals & fit test records for respirator use | YES ☐ | NO ☐ |
| - Respiratory protection training records | YES ☐ | NO ☐ |

12. **Sanitation** **NA** ☐

| | | |
|---|---|---|
| Will the scope of work require the subcontractor to provide temporary washing facilities and toilets? | YES ☐ | NO ☐ |

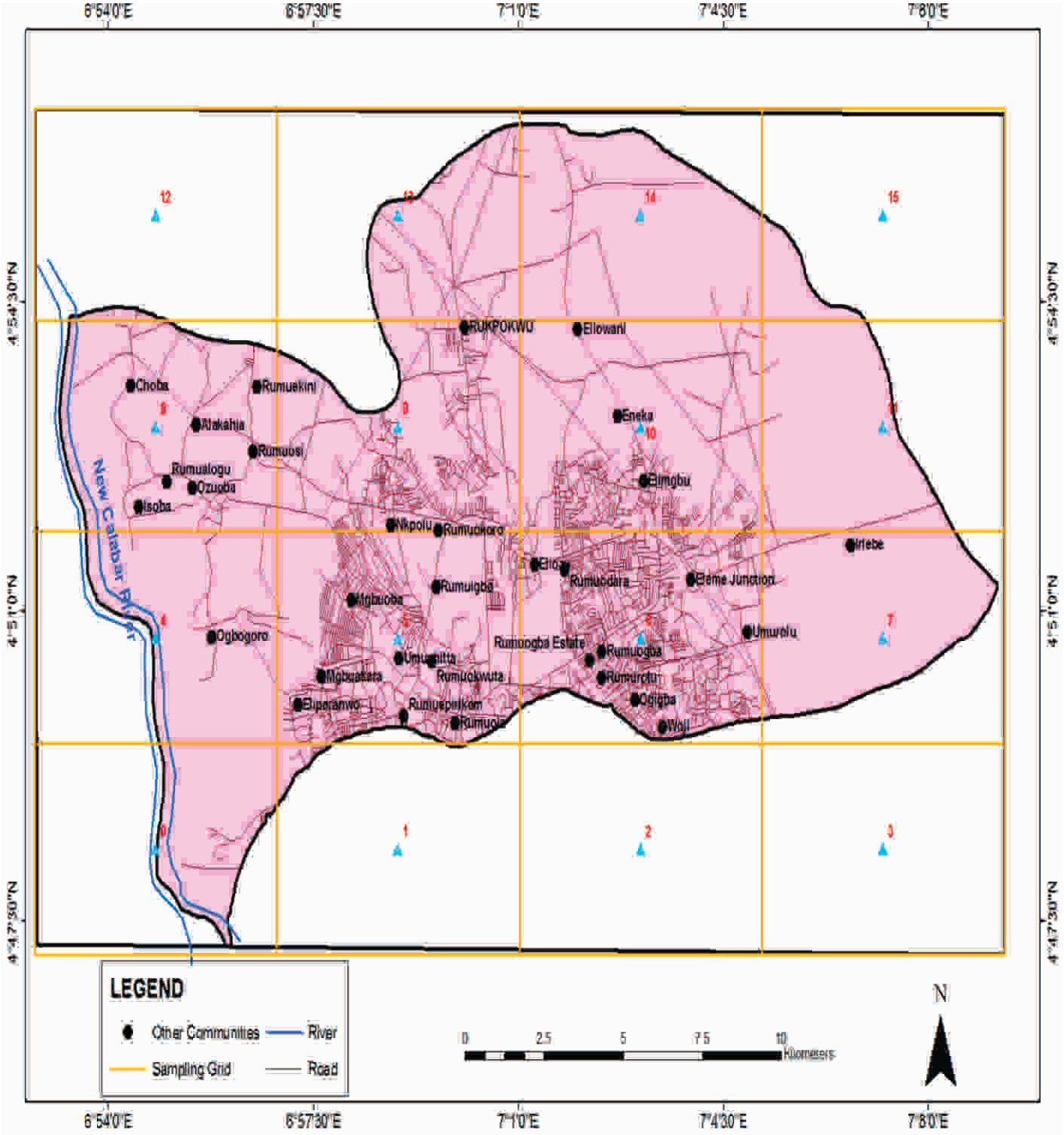
13. **Silica Dust** **NA** ☐

| | | |
|---|---|---|
| Will work involve jack-hammering, rotohammering, drilling, grinding or other disturbance of concrete or use of products that contain crystalline silica that might create silica dust? | YES ☐ | NO ☐ |
| Will work involve wet slab or wall concrete cutting, drilling, and coring or cutting/sanding drywall or joint compound? | YES ☐ | NO ☐ |
| If "YES" to either of the above questions, describe below the method of dust control and control of worker and other persons who could be exposed, such as using wet methods and respiratory protection/training: | | |
| Subcontractor will submit the following items: | | |
| - JHA describing silica hazards and controls | | |
| - Subcontractor's Respirator Protection Program | YES ☐ | NO ☐ |
| - For indoor work: | YES ☐ | NO ☐ |
| Quantitatively fit tested full face-piece, air-purifying respirator along with fit test records | YES ☐ | NO ☐ |
| - For outdoor work: | | |
| Qualitatively fit tested ½ mask negative pressure respirator along with fit test records | YES ☐ | NO ☐ |
| - Medical approval to wear respirators | YES ☐ | NO ☐ |
| - Respiratory protection training records | YES ☐ | NO ☐ |
| - Documentation of silica hazards awareness training | YES ☐ | NO ☐ |

14. **Company Related Programs** **NA** ☐

| | | |
|---|---|---|
| **Heat Related Illness Program** | | |
| Is heat related illness a potential hazard for this scope of work? | YES ☐ | NO ☐ |
| Is a heat related illness prevention program is in place per Cal/OSHA requirements? | YES ☐ | NO ☐ |
| **Ergonomics Program** | | |
| Does the subcontractor have an Ergonomics Program in place? | YES ☐ | NO ☐ |

## APPENDIX B: MAP OF STUDY SITE – OBIO – AKPOR LGA RIVERS STATE



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