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**Research Article**

# COMMUNITY MEMBERS' KNOWLEDGE OF QUARRY SAFETY MEASURES AND STANDARDS AND THEIR PERCEPTION OF HOW RESIDENT QUARRY WORKERS PRACTICE THESE SAFETY MEASURES: A CASE STUDY OF AKAMKPA LOCAL GOVERNMENT AREA, CROSS RIVER STATE, NIGERIA

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**Abstract**

**Introduction:** Quarrying is fraught with dangers and risk of accidents. To this end, those who operate these quarries have put in place various safety measures based on established standards and international best practices aimed at protecting or safeguarding the health and physical wellbeing of their workers. Ideally every worker in the quarry ought to be abreast with every operation of the quarry that is accident prone and to take necessary precautions to avoid being injured or even killed while engaged or working in the quarry. It is also imperative for community members who live near quarry sites to be equally knowledgeable about the potential risks they face and how they can ameliorate these risks. **Method:** A cross sectional study design was employed for this study. A pretested and validated questionnaire was administered to 291 randomly selected respondents in the quarry communities in Akamkpa LGA, of Cross River State, Nigeria about their perceptions regarding the knowledge and practice of the safety measures by the quarry workers. **Results:** The findings of this study showed that most 118 (40.5) of the community members residents within the environs of the quarry sites were aware of the safety kits requirements for the prevention of occupational hazards in the quarries. 131 (45%) of our respondents, based on their observations reported that the quarry workers were consistent in their use of PPEs; while 132 (45.5%) had a contrary opinion. **Conclusion:** The community members reported a slightly higher non-compliance with the use of PPEs as opposed to those that used PPEs consistently. Moreover, the incidents of quarry accidents reported is a cause for concern that speaks volumes about the poor safety standards in the quarries in the study area. It was therefore recommended that the government regulatory agencies need to step up their supervisory roles to ensure that established safety protocols for quarrying in the quarries operating in Akamkpa LGA, Cross River State, Nigeria, are carried out are in line with global best practices.

**Keywords:** Stone quarry, Quarry related accidents, Safety standards, Personal protective equipment.

## INTRODUCTION

A quarry is a place where sand, gravels or stones are extracted, processed and sold (HSE, 2020). Mining and quarrying are hazardous occupations that exposes the workers to various risks including the risks of both minor and serious injuries that could result in the individual(s) being maimed for life or even killed in the process. Stone mining involves the use of explosives such as dynamite for blasting rocks and heavy machines and tools to break large boulders and heavy rocks into smaller sizes for easy evacuation. These activities are very dangerous and not free from possible errors in judgement or timing; thereby predisposing those igniting the fuse of the explosives to being accidentally blown to pieces or even hit by fly rocks. As noted by the Aggregate & Sand Producers Association of South Africa, (ASPASA, 2015), the quarry industry is intrinsically prone to accidents, recording higher incidents and fatalities compared with the construction and manufacturing industries, therefore it requires more vigilance and concerted efforts at safe-guarding the lives and wellbeing of those working in that industry. As earlier alluded to, accidents and associated fatalities in quarries could result from the blasting and rock excavation processes. It could be due to workers falling from heights or being trapped or entangled during the maintenance or operation of the equipment and machinery. Accidents could also happen from the malfunction of machines, while injuries could also result from falling objects such as rocks or fly rocks. Incidentally, injuries from fly rocks are not only limited to quarry workers.

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Residents who live around quarries are equally at risk of being injured by fly rocks (HSE, 2013). Because of the inherent dangers and risks associated with quarrying, there is need for the building of a safety culture both among the quarry operators and their employees. This implies that both the individuals and the quarry operators will commit to ensuring a personal responsibility for safety and would act to preserve and protect the safety of all who are engaged in the quarry industry. Moreover, the operators or management of the quarries should equally obligate themselves to respond promptly to safety concerns that are raised by the employees. Additionally, the quarry workers should also be willing to modify their work ethics, behavior and practices to safeguard their personal safety and that of their fellow workers based on antecedents of incidents that have occurred as a result of carelessness, neglect or failure to comply with the existent safety regulations (State of Queensland, 2019). It is therefore important that those who have been engaged as workers in the quarries be well informed about the potential occupational risks or dangers that they may face in the course of the various upstream extractive quarry operations, as well as the possible attendant mishaps that are associated with the downstream processing lines leading to the production of granite chippings or granite sand which are needed in the construction or building industries (HSA, 2019). Quarry workers therefore have the responsibility to use correctly at all times the personal protective equipment (PPE) or safety equipment given them by their employer. This equipment includes: hearing and respiratory protections, hard hats, gloves, steel toe-capped boots, seat belts in vehicles and safety harnesses. Workers who have any difficulties with the PPE or safety equipment provided ought to raise it with their employer so they can be properly guided or enlightened as to

why they need to put on the PPE or if it is really necessary, to explore other alternatives that may be available, (HSE, 2013). To the best of our knowledge there is no known study that has been undertaken in the study area to access the knowledge of the residents in the quarry communities in Akamkpa LGA, in Cross River State, Nigeria, about the operational safety and precautionary measures of the quarries and the levels of compliance by the local residents of the quarrying communities who have been engaged to work in the quarries.

## STATEMENT OF THE PROBLEM

It is not unusual for community members who are residents in locations where large deposits of solid minerals including granite, limestone, shale-stone etc. have been found to be acquainted with routine quarrying safety measures. Quarry industries are required by both international laws and in-country legislations to ensure that established safety standards are maintained in the strict sense. The management of the quarries are expected to provide operational safety equipment for those involved with the extraction, transporting and processing of the mineral. Evidences from some studies (Aliyu and Shehu, 2006; Mabika, 2018; Ilo *et al.,* 2018) have shown that the operatives of the quarries or mines often do not comply to the letter with these operational regulations or standards. Moreover, interestingly, the quarry workers equally put themselves at risk by not complying with those safety standards. This informed the need to explore the extent to which community members hosting quarries in Akamkpa LGA have good knowledge about the requisite quarry safety measures and their level of compliance in observing these safety protocols.

### Objective of the study

The general objective of this study was to determine the community members' knowledge about quarrying operational safety measures and the extent to which these precautionary measures are complied with by the local residents employed in the quarries within Akamkpa LGA.

### Specific objectives

The specific objectives of this study were to:

1. Determine the people's knowledge about the requisite quarrying operational safety standards and measures.
2. Determine the community members' perceptions about the levels of compliance with these safeties measures by the local residents.

Deriving from the objectives, we set the following research questions.

1. What are the community members' knowledge of the operational quarrying safety protocols?
2. What are the community members' perceptions of the levels of compliance with these safety measures by the local residents employed in the quarries?

## METHODOLOGY

A cross sectional descriptive study design was employed to examine the research objectives among the residents of the three randomly selected study sites in Akamkpa LGA. Cross River State, Nigeria.

### Study setting and study population

This study was carried out in Akamkpa LGA of Cross River State, Nigeria. The Local Government area is located in the Southern Senatorial Zone of Cross River State (CRS). The study population included all adult 18 years and above residents in the three selected stone quarry communities.

### Study design and sample size determination

A cross-sectional descriptive study design was carried out in the three quarry communities in Akamkpa LGA of the state. the effects of quarrying using both structured and semi-structured questionnaire. The Lutz formula (1982) was applied in selecting the study sample which was 266. To account for attrition bias, we added an estimated 10% non-response rate which is an additional number of 26 subjects, that brought the total required sample size to 292.

### Sampling and data collection procedures

A multistage sampling technique was applied in the selection process. Stage 1, involved the selection of the three quarrying communities out of all existent quarry communities in the LGA through simple balloting. A systematic sampling technique was used in Stage 2 to select the households; while the balloting method was then used to select the respondents from each selected household. A pre-tested and validated interviewer administered questionnaire with both open and close-ended questionnaire was utilized in collecting the required data.

### Method of data analysis

Data entry and analysis was carried out using the Statistical Package for Social Sciences (SPSS). The results were presented as descriptive statistics using tables and figures.

### Ethical clearance

Ethical clearance for the study was given by the Ethical Committee of the Public Health Department, College of Medical Sciences, University of Calabar. The respondents gave their verbal Informed consent for the study.

### Rationale for this study

Community members are a repository of information about the types and frequency of quarry-related accidents that occur in the various quarry sites in their communities Several studies (Aigbokhaode *et al.,* 2011; Aliyu and Sheho, 2006; Ezisi *et al.,* 2017), have been conducted to assess the knowledge of quarry workers about hazards in the quarry industry and their use of protective gears to safeguard against accidents and injuries in the quarries. However, to the best of our knowledge no study has been conducted to assess the knowledge of community members who reside in the environs of quarry sites about the types of personal protective equipment (PPEs) used by resident quarry workers and the frequency of its use by these workers. We therefore decided to explore what community members in selected quarry sites in Akamkpa LGA, in Cross River State Nigeria know about the existence and use of personal protective equipment (PPE) safety gears and its use by the resident quarry workers in their communities. Moreover, we also assessed their knowledge of quarry-related accidents.

## RESULTS

### Socio-demographic characteristics of the respondents

As displayed in Table 1, the socio- demographic characteristics of sampled respondents showed that 164 respondents (56.4%) were males and 127 respondents (43.6%) were females. The age distribution of the respondent revealed that the highest number of respondents 115 (39.5%) were in the 20-29years age bracket; they were followed by 68 respondents (23.4%) aged 30-39years and respondents ages 40-49year were 46 (15.8%). The result also showed that people with secondary level of education were dominant with 114 respondents (39.2%), followed by those with tertiary level of education.

**Table 1. Socio-demographic characteristic of the respondents**

| Demographic characteristics | Frequency | Percent (%) |
|---|---|---|
| **Gender** | | |
| Male | 164 | 56.4 |
| Female | 127 | 43.6 |
| Total | 291 | 100.0 |
| **Age (Years)** | | |
| 18-19 | 21 | 7.2 |
| 20-29 | 115 | 39.5 |
| 30-39 | 68 | 23.4 |
| 40-49 | 46 | 15.8 |
| 50-59 | 34 | 8.2 |
| 60 years and above | 17 | 5.8 |
| Total | 291 | 100.0 |
| **Educational level** | | |
| No formal education | 22 | 7.6 |
| Primary education | 38 | 13.1 |
| Secondary education | 114 | 39.2 |
| Tertiary education | 117 | 40.2 |
| Total | 291 | 100.0 |

### Knowledge of the preventive /protective measures against operational accidents at the quarry sites

The results as indicated in Table 2, showed that most 118 (40.5) of the residents of the quarry sites were aware of the safety kits requirements for the prevention of occupational hazards in the quarries. The 118 subjects knew that the combined use of helmets, boots, eye goggles and nose/mouth mask could protect against some preventable accidents in the quarry. Some mentioned the individual safety kits while others mentioned two safety kits in different combinations.

**Table 2. Knowledge of the hazard preventive /protective measures used by the quarry workers**

| Safety kit used by quarry workers | Number of respondents | Percent (%) |
|---|---|---|
| Helmet | 15 | 5.2 |
| Eye goggle | 9 | 3.1 |
| Boots | 51 | 17.5 |
| Nose /mouth mask | 12 | 4.1 |
| All the above named kits | 118 | 40.5 |
| Helmet and goggles | 2 | 0.7 |
| Helmet, boots & nose mask | 14 | 4.8 |
| Helmet & Boots | 21 | 7.2 |
| Helmet & nose mask | 1 | 0.3 |
| No idea | 48 | 16.3 |
| Total | 291 | 100.0 |

### Reported frequency of use of safety gears by quarry workers by the respondents

On their observations of the frequency of use of the protective /safety kits by the quarry workers, 131 (45%) of our respondents reported that the quarry workers were consistent in their use of PPEs, while 132 (45.4%) of the respondents reported that the quarry workers use the protective gears occasionally. Only 16 (5.9%) of the respondents reported the non-use of the safety /protective gears by the quarry workers. See Table 3.

**Table 3. Reported observed frequency of use of protective gears by the quarry workers**

| Reported frequency of use of safety kits | Number of Respondents | Percent (%) |
|---|---|---|
| Always /Daily use of gear | 131 | 45 |
| Sometimes/Occasionally | 132 | 45.4 |
| Non-use of protective gear | 16 | 5.5 |
| No idea | 12 | 4.1 |
| Total | 291 | 100.0 |

### Reported quarry-related incidents /accidents by the respondents

As shown in Table 4, the quarry residents reported several quarry-related accidents. The major accidents were falls 24 (7.9%) and stone crusher accidents 20 (6.9%). Other accidents that were reported included, electric shock 4 (1.4%), Burns 4 (1.4%) and drowning in abandoned quarry pits. 239 respondents (82.1%) however had no opinion on the subject matter.

**Table 4. Types of accidents reported at the quarry sites by the community residents**

| Type of accident reported | Number of Respondents | Percent (%) |
|---|---|---|
| Falls | 24 | 7.9 |
| Stone crusher accident | 20 | 6.9 |
| Electric shock | 4 | 1.4 |
| Drowning in abandoned quarry pits | 4 | 1.4 |
| Burns | 4 | 1.4 |
| No contribution on the subject | 239 | 82.1 |
| Total | 291 | 100.0 |

## DISCUSSION

As observed by ASPASA (2015), quarrying is an implicitly hazardous industry to work in. It is associated with risks that exposes quarry workers to the likelihood of being seriously injured, maimed or even killed in an accident at work. The use of large earth-moving machinery, the handling of explosives and heavy loads of stone, the pervasive airborne dust particles, and the inherent risk in simply working in dangerous quarry sites /locations are all features of quarrying that increase the risk of both accidents and occupational injuries. Fatalities in the quarrying sector are often associated with maintenance work, the use of fixed machinery, heavy duty trucks and falls from height. Many accidents happen during maintenance work and these might affect not only maintenance staff but also other workers on site. There is however a dearth of knowledge about what quarry sites residents know about safety measure that relate to quarrying operations. This study was therefore conducted with the aim of exploring the knowledge of community members who live within the vicinity of quarry sites about occupational safety measures and their perception of the compliance with the safety standards by quarry workers resident in the quarrying communities. We equally sought to assess the awareness of the community members about occupational incidents that have occurred in the quarries and their outcomes.

**Knowledge of the preventive /protective measures against operational accidents at the quarry sites**

The community members in our study had a fair knowledge (40.5%) about the safety gears that are required by quarry workers. 131 (45%) were able to determine that the quarry workers used their PPEs regularly while 132 (45.4) of them opined that the quarry workers at the quarry sites used their PPEs occasionally. In the study by Chepchumba, Kinyua & Gatebe, (2019), among quarry workers in Bomet County, Kenya, 81.7% of the workers were aware of occupational hazards in the quarry, with the main source of information about hazards being their colleagues 45.2%; while only 27.8% of the respondents were aware of safety measures in place. In a related study in Nigeria by Aigbokhaode *et al.* (2011), among 410 quarry workers, only 235(57.3%) were aware of safety measures in the quarries.

**Provision of information on occupational safety in quarries**

The issue of occupational safety is paramount, however reports of studies in Nigeria on safety management in stone quarries in Nigeria is quite appalling. In the study by Esizi *et al.* (2017) among 500 respondents of a stone industry, the subjects obtained their knowledge of the hazards associated with quarrying from their personal experience of eye injury at work 160 (32.0%), co-workers 105 (21%), medical personnel 25 (5%) and the mass media 10 (2%), Incidentally, the quarry management did not provide any health talks on job-related ocular health hazards to the employees.

**Availability and utilization of safety measures**

The findings of our study showed that the community members were aware that the quarry workers resident in their communities were not fully compliant with the use of the PPEs. Aigbokhaode *et al.* (2011), in their study among quarry workers in a rural quarry in Edo State, Nigeria, found that only 117 (28.6%) of the study subjects used personal protective equipment all the time during work hours, while 33.4% used the PPEs occasionally. Alihu and Shehu. (2006) in their study of the occupational hazards and safety measures in stone quarries in Kano, Northern Nigeria, found that all the quarry sites had no hazard prevention safety measures for the workforce. In a similar study by Ezisi *et al.* (2017) involving the 500 participants, comprising 128 stone quarrying and 372, stone processing workers, only 10 (2%) of the 500 study subjects possessed and used the appropriate PPED (i.e., eye goggles). Of the 10 (2%) who used goggles, none used it regularly. More participants in the stone processing group 12 (2.4%) than stone quarry workers group 7 (1.4%) utilized PPED (P = 0.34). Contrastingly, Ilo et al. (2017), in their study among quarry workers Abakaliki, Ebonyi State, Nigeria, found that the mean score for the workers' compliance with measures for ascertaining safe environment was 3.13, which was considered to be high compared with the bench mark assessment criterion for occupational health and safety measures for a safe working environment**.** It should be noted however that, while it is the responsibility of the quarry worker to safeguard his wellbeing, it is also a fundamental responsibility of the quarry management to ensure that safety equipment and measures are in place within the quarry

**The promotion of a safety culture in the quarry**

The need for the establishment of a "safety culture" in potentially dangerous occupations is very paramount. The concept and principles of a safety culture encapsulates the perceptions, beliefs, values and normal behaviors that are shared by employees in a given work place. The hallmarks of a positive safety culture include: open communication at all levels of the organization, that allows for feedback to be provided to improve safety processes; a commitment by individuals at all levels to pay attention to measures that can prevent illness or injuries; an unwavering and uncompromising commitment to safety notwithstanding all other business concerns; the placement of value on people and the guaranteeing of their safety and wellbeing. (State of Queensland, 2019)

**Quarry-related accidents /incidents**

The findings of our study showed that some community members resident in the quarry sites were aware of the occurrence of accidents in the quarries that included, falls, electric shocks, burns and even drowning. Falls in quarries could be fatal. Rock climbing in a quarry or mine are very unsafe because the rock of a high wall of a mine or quarry which has been fractured by blasting can be very much unstable and the rocks that the climber hang or cling on for support are sometimes not quite firm and can break loose if some pressure or weight is exerted on them. In fact, a climber's weight can dislocate an entire face of rock (King, 2017). Abandoned quarries and mines are equally dangerous places and drowning can be a major cause of death in an abandoned quarry or mine. Those involved in this type of accident usually go to the quarry with the intension to swim, unaware or uninformed that quarries are extremely dangerous places to swim. The steep drop-offs, sharp rocks, deep water, submerged electric wires and abandoned equipment as well as the industrial waste make swimming highly risky (King, 2017). It is reported that in a typical year in the United States, several people die in accidents that occur in abandoned mines across the country. Some of these deaths are avoidable or preventable if the citizens knew the dangers inherent in these abandoned quarries or the landowners took the pains to provide warning signs for intruders and if they had also fenced off the property to restrict access. Moreover, the governments ought to have put in place programs for reclaiming the abandoned quarries or regulating access to them (King, 2017).

**Conclusion**

Our study in Akamkpa LGA in Cross River State, Nigeria, was exploratory. It was aimed at assessing the knowledge of community members living in proximity to quarry sites about their knowledge of safety gears and measures for quarrying and their perception of the compliance of the safety measures; additionally, our study explored the reports of accidents in the quarries and their outcomes. Every human endeavor or occupation has an inherent associated risk for which certain protective gear or equipment are recommended. For the quarry industry, the risks are multifarious, ranging from environmental degradation, physical injuries and health-related effects. Crusher and trucks accidents due to poor judgments by machinery operators have also resulted in preventable fatalities. The quarry employees who are at the forefront in the exploitation industry bear the brunt of the hazards, risks and fatalities at the jobsites in the quarries. The Personal Protective Equipment (PPE) is intended therefore to protect or safeguard employees from hazards in the workplace that could potentially cause serious illness or injuries. The basic PPE that

are prescribed for the operations in a quarry industry includes: crash helmets, eye protection goggles, hearing protection, high-visibility vests, steel toed safety boots, gloves, and appropriate medically cleared and test fitted respiratory protection nose masks. The onus is therefore on the quarry operators to provide these PPEs for their employees, while it is also the responsibility of the quarry workers to wear the protective gears. The findings from our study, exemplified a negative safety culture. The quarry management did not follow safety rules in the strict sense. The inconsistent use of the PPEs is an indication that the quarry management did not enforce the wearing of the PPEs. The compliance with safety measures by the quarry employees can be considered to be very poor. The numbers of reported accidents in the quarry sites is worrisome. This reinforces the poor safety standards in the quarries in Akamkpa LGA. The quarry operators and management have the moral obligation to ensure that optimal operational safety standards are maintained at the quarries. On the other hand, the quarry employees are equally required to observe the requisite safety measures that have been designed to safeguard their lives and well-being. The need for a strict adherence to the "safety culture" of quarrying by both the management and employees alike is indispensable to ensuring the safety of the workers.

**Recommendation**

The findings of the study indicated that there was no formal training program to educate the quarry employees about the jobsite hazards and the need to observe the "safety culture". There is an urgent need therefore for the building and entrenchment of a safety culture in the quarries, in this regard, appropriate mechanism should be established to train and certify all applicable employees about safety measures at the jobsite as required by government regulations. In addition, all employees should undertake and complete the requisite site-specific quarry safety courses relating to fall protection, safe machine operations, avoidance of fly stone accidents, etc.) before commencing work. It is therefore imperative that every quarry worker should have the requisite competencies and skill sets for the work they are required to perform. It is therefore pertinent that the employees and their managers, have a firm understanding of the limits of their competence. In this regard no quarry worker should perform any work for which they do not have the requisite competency, except under the careful supervision and guidance of a competent instructor. Existent health and safety measures need to be checked routinely, monitored and reviewed in a systematically manner to ensure they are functioning optimally and accurately as intended. Safety measures could fail because people are ignorant of them, are too busy to comply with the instructions or people may consider them to be unimportant. The measures may also fail because they are obsolete or flawed; consequently, there should be regular risk assessment checks to identify potential hazards and risks that may be associated with each activity in the quarry and appropriate control measures should be instituted to ensure that the danger to persons is mitigated. These occupational guiding principles can be considered to be the ideal, with an employee-centered focus on safety. These ideals would however, need to be contextualized within the ambits of a particular industrial setup or occupation setting. Those who work in quarries for instance, need to be mindful of all the different operational aspects of the quarrying activities that pose a threat to life and wellbeing.

**Limitation of the study:** Considering the fact that our search of the available literature on the knowledge and perceptions of community members' living in proximity of quarry sites of the safety standards of quarries, and the compliance by quarry workers with the safety standards, did not reveal a comparable study, we had to compare our respondents' responses with that obtained from the quarry workers described by the various researchers we cited. This limitation however does not obviate the validity of our study, but opens up a vista for additional exploratory studies by other researchers.

## REFERENCES


Aggregate & Sand Producers Association of South Africa (ASPASA, 2021). Best Practice Guideline Safe Maintenance – Quarry Industry in South Africa. Accessed at: https://associationfinder.co.za/?s=Best+Practice+ Guideline+Safe+Maintenance+%E2%80%93+Quarry+Industry+in+South+Africa

Aigbokhaode, AQ, Isah, EC, Isara, AR. Knowledge And Practice of Occupational Safety Among Quarry Workers in A Rural Community in Edo State, *Journal Of Community Medicine And Primary Health Care,* VOL. 23, NOS 1&2, MAR/SEPT. 2011

Aliyu AA, Shehu AU. Occupational hazards and safety measures among stone quarry workers in Northern Nigeria. Nig Med Pract. 2006; 50(2): 42-47. DOI:10.4314/nmp. v50i2.28838

Chepchumba J., Kinyua R. and Gatebe E. Assessment of occupational hazards awareness and safety measures among quarry workers in Bomet county, Kenya. *International Journal of Recent Research in Social Sciences and Humanities (IJRRSSH)*, Vol. 6, Issue 1, pp: (19-28), Month: January - March 2019, Available at: www.paperpublications.org

Ezisi, C. N., Eze, B. I., Okoye, O. and Arinze, O. 2017. Correlates of Stone Quarry Workers' Awareness of Work-related Ocular Health Hazards and Utilization of Protective Eye Devices: Findings in Southeastern Nigeria. *Indian journal of occupational and environmental medicine*, *21*(2), 51–55. https://doi.org/10.4103/ijoem. IJOEM_171_16

Health and Safety Authority (HSA, 2019). Safe Quarry: A Guide for Quarry Workers. Accessed at: https://www.hsa.ie/eng/publications_and_forms/publications/mines_and_quarries/safe_quarry_-_a_guide_for_quarry_ workers.html

Health and Safety Executive-HSE, 2013. Health and Safety at Quarries: The Quarries Regulations 1999; The Approved Code of Practice, L118 (2013, Second Edition).

HSE 2021, Quarries sector strategy 2012-15. Accessed at: https://www.hse.gov.uk/aboutus/strategiesandplans/sector-strategies/quarries.htm

Ilo CI., Njoku PO., Nwimo IO. Elom, NA. and Orji SA. 2018, Workers' compliance with measures for safe environment in quarry industries in Abakaliki tTwn of Ebonyi state, Nigeria, Chemical Engineering Transactions, 63, 661-666 DOI:10.3303/CET1863111

King H.M. 2017. Most of the victims are young and went to the quarry to swim or ride an ATV. Accessed at: https://geology.com/articles/abandoned-mines.shtml.

Langner, K. 2021. How to Improve the Safety Culture at Your Aggregate Quarry Site. Accessed at: https://mastery.commandalkon.com/command-alkon/how-to-improve-the-safety-culture-at-your-aggregate-quarry-site

Mabika B. 2018. Improving Workers' Safety and Health in the Zimbabwean Mining and Quarrying Industry. A Doctoral Dissertation in the College of Management and Technology, Walden University. Accessed at: https:// scholarworks.waldenu.edu/cgi/viewcontent.cgi?article=6778&context=dissertations

State of Queensland, 2019. Mining and Quarrying Safety and Health Regulation 2017, Current as at 1 October 2019. Accessed at: http://extwprlegs1.fao.org/docs/pdf/qs177090. pdf


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