

SAFETY ENGINEERING

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ABSTRACT

Safety is the state or condition of freedom from danger or risk. It cannot be restricted to a field alone it is what's applicable to us in our day to day activities. This work covers safety in large organizations in relation to personal, fire and gas and automobile. Other areas which this work cover are safety at the place of work, safety of site in relation to protection of an individuals from the consequences of its own actions, safety of road men from potential hazard on a particular site (electricity, examinations and falls) and safety of road men from another's actions, regulations and rules as it relates personal, safety habit, workshop safety habits, tools safety, workshop machines tools safety and electrical equipment safety. This work sheds light on the characteristics of fire and the causes of fire outbreaks in public buildings (office buildings, hotels, cinema halls, warehouses etc). Also, it gives details on fire protections, precautions and means of escape in case of fire.

KEYWORDS: *Safety, Environment, Equipment*

I. INTRODUCTION

From the cradle to the great people are exposed to a great variety of hazard based on the environment in which they carry out their daily activities. At the recent time due to technological development, man's work becomes more sophisticated than before in terms of materials, equipment and machineries. There are hazard in the street, at home and in factories/workshop work in the utility field is potentially more hazardous than in other occupation but confirming to safe practices, one can attain working in a more manageable harmless working environment. Safety is an act of incubating the necessity of taken precaution for the avoidance or reduction of accidents in order to protect people and property. Safety in work place is concerned with all the safety mechanism put in place by employer individual to ensure, as much as possible, the avoidance or elimination of accident in industries or work place. Okorie (2000). Generally, safety is required in any daily activities involving human being either at work or at home. It is equally important that all reasonable worker or human being at work should always place, priorities or safety before performing any functions or duties which could be terms as "SAFETY FIRST". This idea is applicable in some organizations but still need to be practice by each individual in any environment.

II. SAFETY AT THE PLACE OF WORK

Both the employers and employee had to cooperate to enable a safe working place to exist. In a construction site supervisor will need to;

- [1] Identify potential hazards that could exist on the site and take the necessary precautions.
- [2] Be vigilant in ensuring that young under 18 years and holder men are not placed upon work that is new to them they must be adequately trained and supervised on their work.
- [3] Ensure that all practices on site confirm with appropriate legislation (law).
- [4] Attempt to improve on the minimum – requirement by say, encouraging a dean, orderly is – well stake material and clear access route.

SAFETY OF SITE

The following safety should be considered when taken precautions to ensure safety on a highway site.

- [1] The production of an individual from the consequences of his own action.
- [2] The safety of road men from potential hazard on a particular site.
- [3] The safety of road men from one another's actions.
- [4] The safety of the traveling public.
- [5] The protection of road men from the traveling public.

THE PROTECTION OF AN INDIVIDUAL FROM THE CONSEQUENCES OF ITS OWN ACTION

Ignorance of the work process involved or carelessness will cause a man to injure himself through his own actions. Many accidents could be prevented with the use of protective equipment such as;

- a. Protective spectacles, goggles or visor when working with hammers and chisels or cutting machineries at concrete or stone.
- b. Helmet when working below other work men or in situations where object are liable to fall from above.
- c. Protective boots with steel caps and soles will prevent injuries through crushing and treading on nails.
- d. Gloves in manual activities such as curbing etc.
- e. Face mask when cutting concrete or stone with disk cutters.
- f. High visibility and reflective jackets for men working on the highway.
- g. Far muffs are plugs when using compared air tools such as breakers and drills and also with pilling equipment.

III. THE SAFETY OF ROAD MEN FROM POTENTIAL HAZARD ON A PARTICULAR SITE ELECTRICITY ON SITE

- [1] **Underground cables:** Some cables are armored by a wrapping of steels tape but many have only light covering which can easily be damaged by excavators or with hard tools like pickaxe when buried at depth between 450mm to 1m. First check the electricity had been disconnected from mains when demolishing building.
- [2] **Services in vicinity of site:** Before and during precaution must be taken to prevent accidental contact with live underground or overload cable. Disconnecting or divert the electricity supply authority's cable.
- [3] **Supply for site:** When temporary lightning is installed or portable tools are used the risk of serious injuries can be reduces by wings a transformer to reduce normal supply voltage of 250v to 230v or less.
- [4] **Overhead electricity lines:** They are usually insulated and if a metallic object is brought into contact or in close. Proximity with an overhead conductor then an electric current will discharge through the object to earth, with this precautions should be taken to prevent crane jibs, scaffold poles or vehicle tipper bodies getting too dose. A method is to erect "good posts" which will channel plant along a particular route and through the posts.

EXCAVATIONS

Many dangers arise from excavation. The principle danger is that of the collapse of the site of an excavation. Since all ground will collapse under certain conditions an excavation should be clearly supported (timbering) or the sites should be sloped to a safe and angle as soon as the excavation reaches a depth where men could be buried or trapped should a collapse take place.

FALLS

Almost half the accidents in construction work are done to the falls of men or materials. Men not only fall from working places, they slip and fall when making their way from one part of the site of the part to another and can also be injured when badly stacked materials fall on to them.

To prevent persons from falling:

1. Provide hand rails for stairs and gangways over trenches.
2. Check that any safeguard, such as guardrails, tailboards, handrails and covers over opening in floors, which have been provided are kept in place.
3. Keep the site tidy and get rid of rubbish, stove materials methodically and establish door routes through the site.
4. Fence or cover all openings in floors, holes and ground and similar hazards.
5. Provide good lighting on stairs, passages and other access route.
6. Use only well - constructed ladders properly secures, suitable scaffolding for all work that cannot be done safely from ground.

To prevent materials from falling:

1. Material should not be through down haphazardly from a height lower than or provide a chute or if material are to be thrown down off the area into which they will fall.
2. Ensure that materials are properly staked and that they are not likely to be blown or knocked over.

3. If persons are working regularly in places where they are liable to be stuck by falling materials, provide a strong protective cover. Similar protection is advisable over passageways in common use. Provide safety helmets.

IV. THE SAFETY OF A ROADMEN FROM ANOTHER'S ACTIONS.

Many dangers arise from the thoughtless actions of men unconcerned with the safety of their workmates. Some of the most common and those resulting in high incidents are listed below:

- a. Trading on nails projecting from loose timber in a common site accident.
- b. Not reporting defects in machinery and equipment resulting in unsafe plant being used by others.
- c. Creating makeshift and unsafe situation such as sub-standard electrical connections and trailing cables etc.
- d. Failure to replace guarding equipment after carrying out work which necessitates its removal.
- e. Careless operation of machinery without ensuring proper safeguards such as help in reversing or use of a bankman with cranes or earthmoving machinery.

SAFETY RELATION TO PERSONNEL IN AN ORGANIZATION

In large organization induction courses are organized for new staff in order to carry out his duties which are administered by the personnel department. This induction will cover policies of the organization, chain of command, introduction to company machinery, introduction to equipment to be used. Sometimes at the induction the new employee will be acquired.

SAFETY IN RELATION TO FIRE AND GAS

Firefighting (fire extinguisher) is recommended in all laboratories workshops, buildings vehicles, rigs etc. In large organization personnel are trained on how to use fire-fighting equipment during fire drills and training exercises. The fire extinguishers shall be marked with an identification symbol and the letter(s) that indicate the class of fires they shall be used for.

The fires shall be treated depending on their class:

CLASS A FIRE: Occurs in common materials such as wood, paper mattresses, rag, rubbish etc. the quenching and cooling effect of water or water solution is recommended.

CLASS B FIRES: occurs in the vapour-air mixture over the surface of flammable liquid such as gasoline, oil, grease, paints and thinners. Class B fires are extinguished by limiting air (oxygen) or by providing combustion-inhibiting agent.

CLASS C FIRE: Occur in or near electrical equipment non-conductive extinguishing agents must be used.

CLASS D FIRES: Occurs in combustible metals such as magnesium, titanium, zirconium, lithium and sodium. Specialized techniques, extinguishing agent and equipment must be used to control this type of fire. Generally all vehicles supposed to have a road-book, indicating the mileage and the maintenance performed. To avoid unnecessary accident the driver is expected to conduct a daily inspection of his/her vehicle, what should be checked are:

1. Engine oil level
2. Engine cooling fluid level (water in radiator)
3. Tyres condition and pressure
4. Automotive lights (full, dim, brake, parking, reverse)
5. Spare tyre and jack
6. Automotive documents
7. Windscreen document.

In vehicle seat belts are supposed to be worn by all passengers prior starting the engine (for front rear seats). Pregnant women who might feel discomfort from the seat belts and children under 10 years old shall not be allowed in the front seat. It is also very important that the driver must have driving license recognized by the local authority. Also drivers are expected to be trained in defensive driving. The driver should not be under influence of alcohol (more than 0.3 g/l), narcotic or drug is forbidden. The driver is supposed to know the driving speed for some areas and roads for example:

Driving speed shall not exceed in any case:

- Paved roads outside built up areas..... 120kph
- Gravel roads 70kph

- Build up area 50kph
 - Work site 5kph
- Driving at night should be avoided as much as possible because of Visibility.

PERSONAL SAFETY HABITS

1. Remove loose fitting outer garments
2. Keep long hair of eyes
3. Remove or tuck tie in, close to collars
4. Roll up long sleeve shirts above elbows
5. Wear wrist watches and jewellery when using machine
6. Wear shoes with strong toe cap
7. Wear protective clothing e.g. close fitting apron tied at the back

WORKSHOP SAFETY HABITS

1. Walk and do not run in the workshop
2. Make sure your working space is clear of pieces of wood and stone
3. Always wash your hands before and after work
4. Note the positions of fire aid box and fire extinguishers.
5. Keep tool and equipment in appropriate places immediately after use
6. Be sensible to fooling around and no noise making in the workshop.
7. Report any injury, no matter how minor it may be to the personnel in the workshop
8. Remove paint, oil and grease from the floor immediately.

HAND TOOLS SAFETY

1. When passing sharp edge or pointed tools to another person pass them through by the handles.
2. Do not carry too much tools at once.
3. Store tools kits or in correct places immediately after use
4. Do not sharp edged tools of pointed tools without protecting the ends.

WORKSHOP MACHINE TOOL SAFETY

1. Observers should stand at a safe distance away from the machine.
2. Observe correct workshop clothing rule and wear ear plugs and goggles or eye shield.
3. Make sure there is adequate working space to operate the machine safely.
4. Do not interfere with switches or controls of a machine without permission.

ELECTRICAL EQUIPMENT SAFETY

1. Check the plugs frequently for fracture
2. Do not use damp or faulty lead
3. Do not use crack or faulty plugs
4. Store power tools and lead in a dry place when not in use
5. Report any damaged leads, plugs or switches to the right personnel
6. Always making sure your hands are dry and don't stand on damp floor when plugs, of equipment after use.
7. Switch off and disconnect plugs of equipment after use
8. Do not drag electrical cable on the floor

CHARACTERISTICS OF FIRE

Fire or combustion is the process of burning, it is a chemical reaction in which a substance combines with oxygen in the air and the process is accompanied by the emission of heat light and sound. Three things are essential before a fire can occur; they are a combustible substance, oxygen and initial source of heat. Remove anyone of these and the process of fire will cease.

Fire extinction consists the limitation of one or more of these factors as explained below.

- a. Starvation (or the limitation of fuel)
- b. Smothering (or the limitation of oxygen)
- c. Cooling (or the limitation of temperature)

Causes of fire incidents in public buildings.

Human factors which bother on moral and physical hazards have been identified as causes of fire incident in public buildings. However, a good number of reported cases of fire outbreak in public building (especially in Nigeria) are such that the main causes of the fire are not made public. This is a discredit as it due

not allow the people to learn from the experience of the past so as to know and learn how to avoid the causes of fire outbreak.

The under listed are the major causes of fire in various public building:

- a. Careless handling of fire e.g. careless smoking of cigarette
- b. Enemy actor or arson
- c. Rubbish burning
- d. Electric/mechanical spark
- e. Improper maintenance of machineries or engines
- f. Lighting, tremors and earthquake - natural causes
- g. Bad Storage of flammable liquids and other combustible material
- h. Chimneys - Any defect in the basic principle of operation of it.
- i. Spontaneous Combustion - e.g. reaction of quicklime with water in laboratory.
- j. Naked light e.g. welding and cutting operation or use of blow lamps.
- k. Friction - e.g. tension adjustment on belt driven machinery, serious over heating can be caused if the belt is to loose or too tight.

FIRE PRECAUTIONS

Fire can be prevented by using the following means:

1. Smoke detectors - this gives a quicker response time than heat detector as fire outbreak will often give a pulse of smoke or combustion products in early stage of fire developments before rise in temperature is apparent.
2. Automatic fire extinction - having considered automatic detection it is logical to move into automatic extinction.
3. Automatic water systems: it provides a convenient form of protection which can operate without human factor. Water may be applied in form of coarse droplets or as a mist of fog and supplied by a system of mains and branch pipes which may be their wet or dry.

V. RECOMMENDATIONS

It is advisable that a man must be trained or made familiar with any techniques before being allowed to begin work. When timber framing or shuttering or dismantled, nails should be removed or knocked flat or the timber should be stacked where it cannot be trodden on. Almost half the accident in construction works are due to the falls of men or materials, men not only fall from working places, they slip and fall when making their way from one part of the site to another and can also be injured when badly stacked materials fall to them. To prevent person from falling keep the site tidy and rid of rubbish store material methodologically and establish clear routes through the site. Provide hand rails for stairs and gangways over trenches. Fence or cover all openings in floors, holes in ground and similar hazards. Provide good lighting on stair, passages and other access routes use only well construction ladder properly secured, and where necessary, check that any safeguards, such as guardrails, toe boards covers over openings in floors which have been provided are kept in place for properly safety precautions. For any reportable accident, an accident investigation shall be carried out on site and an analysis shall be made to determine the action(s) to be taken for preventing re-occurrence.

VI. CONCLUSION

Far too often, rather than actually influencing the design safety engineers can be assigned to prove that an existing, completed design is safe. Problems late in the design process, correcting them can be very expensive. This type of error has the potential to waste large sums of money so it should be avoided. There is great need to improve fire services all over the state of the federation. Thousands of lives and properties would have been saved if the department had been functioning well. The issues of transportation and equipment in case of fire outbreak can be solved by providing modern vehicle and modern firefighting equipment to replace obsolete one still in use now.

REFERENCES

- [1]. Arthur Wiguall, Peters. Kendrick (1982): Roadwork Theory and Practice (1st Edition) London: Publishing in Association with the Institution of Works and Highways Technician Engineers by Heinemann: London.
- [2]. Aremu J.A, Olaoye I.O., Ariwoola I.A., Asimi M.A. (2001): Introduction to Wood Technology (1st Edition).
- [3]. Feyon A., Bobillier A.: Health, Safety and Environment Manual (3rd Edition).
- [4]. Okorie J.U (2000): Developing Nigeria's Work Force (1st Edition)
- [5]. Walton, John A., (1979): Wood in Theory and Practice (5th Edition).
- [6]. Olayinka A.R and Ojo O.S (1996): Fire Safety in Public Building Company (1st Edition).