



### TECHNICAL INVESTIGATION ON THE CAUSES AND CONTROL OF WORKSHOP ACCIDENTS AT PROJECTS DEVELOPMENT INSTITUTE, ENUGU

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#### ABSTRACT

Technical investigation on the causes and control of workshop accident at Projects Development Institute (PRODA) Enugu in Enugu state of Nigeria was carried out and a survey made involving the use of questionnaire and personal interview during the field trips. The aim

was to technically investigate on the causes of accidents at PRODA in Enugu State and suggest the possible means of control and prevention. The author was able to issue 120 questionnaires to 120 staffs randomly and 118 questionnaires were recovered and workshops in six (6) departments were visited. The investigation survey was carried out from machine operators and other relevant staffs attached with machine at Projects Development Institute (PRODA) Enugu in Enugu State of Nigeria. The results of the survey showed that 1 - 10 casualties was recorded in a month and lower than 30 casualties in a year. The researcher has also found that the highest causes of accidents in the workshops are the wrong use of machines, machine malfunctioning, dirtiness and wrong layout of machine in the workshops. The author gathered that 45.8% of the respondent scored the management badly in control and check of workshop accidents while 28.8% scored them good which means that management does not provide all the necessary materials required for control and prevention of workshop accidents. Also, they don't organize workshop, seminar or symposium on the safety tips, prevention and control as standard for controlling workshops accidents. It was concluded by the author, that Controlling and prevention of workshop accidents should not be

ignored and also requires the concern of the management, government, Engineers, Technologist, Technicians, supervisors and other workers in workshops. The author recommended that there is a need to strictly adhere to workshop safety rules and regulations and should be revisited from time to time. Also, that the practices for preventing and avoiding workshop accidents include eliminating shortcuts, implementing emergency drills, and being aware of inherent job risks.

## INTRODUCTION

An accident is a mishap, which causes injury to men, machines or tools and equipment. Injury may result either death or temporary disablement or permanent disablement of the employees. Accident is an unplanned, not necessarily injurious or damaging event which interrupts the completion of an activity; it is invariably preceded by an unsafe act or unsafe condition or both or some combination of unsafe acts or unsafe conditions (Ujam and Idogwu, 2012).

It has been experimentally established that a high percentage of accidents results from a combination of unsafe acts (poor work practices, lack of judgment, inattentive, recklessness etc) and unsafe conditions. Accidents have occurred seldom solely from an unsafe condition. It has also been triggered by faulty design or construction of machines tool being handled, poor housekeeping, operating practices that created hazards, or lack of standardization and identification which so confuses the operator that he is literally trapped into making mistakes (Leveson, 2004).

Industrial accidents occur due to certain acts on the part of workers. These acts may be the result of lack of knowledge or skill on the part of the worker, certain bodily defects and wrong attitude. Here are the unsafe acts of accidents cause, which include Shortcuts, Overconfidence, Poor, or Lack of housekeeping, Starting a task before getting all necessary information, Neglecting Safety Procedures, Mental Distractions, Lack of Preparation, etc (Tuominen and Saari, 1982).

These causes arise out of unsafe situation and climate conditions and variations. These may include excessive noise, very high temperature, humid conditions, bad working conditions, unhealthy environment, slippery floors, excessive glare, dust and fume, arrogant behavior of domineering, supervisors etc (Harms-Ringdhl, 2009).

Accidents may be of different types depending upon the severity, durability and degree of the injury. An accident causing death or permanent or prolonged disability to the injured employee is called 'major accident. A cut that does not render the employee disabled is termed as 'minor' accident. When an employee gets injury with external signs of it, it is external injury (Jain, 2013).

Injury without showing external signs such as a fractured bone is called an internal one. When an injury renders an injured employee disabled for a short period, say, a day or a week, it is a temporary accident. On the contrary, making injured employee disabled for ever is called permanent accident. Disability caused by accident may be partial or total, fatal or non-fatal (Jain, 2013).

An accident (industrial) is a sudden and unexpected occurrence in the industry which interrupts the orderly progress of the work. According to the Factories Act, 1948: "It is an occurrence in an industrial establishment causing bodily injury to a person who makes him unfit to resume his duties in the next 48 hours". In other words, accident is an unexpected event in the course of employment which is neither anticipated nor designed to occur. Thus, an accident is an unplanned and uncontrolled event in which an action or reaction of an object, a substance, a person, or a radiation results in personal injury. It is important to note that self-inflicted injuries cannot be regarded as accidents (Aven, 2008).

When an accident occurs on the shop floor the maximum sufferer is the victim who has to bear the pain due to injury, the mental agony he and his family members suffer due to the accident. The supervisor's agony is that he losses productive worker. Management has to bear the compensation, medical expenses etc. Society as to bear the burden due to overall cost of accident, may be supporting the injured workers family or supporting the lame or incapacitated worker for life also (Chaplin and Hale, 1998).

Accident prevention has been traditionally based on learning from accidents and near accidents (near misses). By investigating every incident, we learn about causes and can take actions towards mitigating or removing the causes. The problem is that we have not been able to develop, in the absence of sufficiently good theories, investigation methods which would bring up all the relevant factors for prevention. An investigation may give a fairly good picture about the causes. However, this picture is usually relevant only for the specific case investigated. There may be conditions and factors which contributed to the accident whose

connections the investigators do not recognize or understand. Generalizing from one accident to other situations bears a degree of risk (Lars, 2013).

The good news is that we have made considerable progress in the area of predictive safety management. A number of techniques have been developed and have become routine for industrial safety and risk analysis. These techniques allow us to study industrial production plants systematically for the identification of potential hazards and to institute appropriate action before anything happens (Salmon, et al, 2012).

One of the new steps in safety management is the notion of safety culture. It may be a difficult concept, since culture is not a visible entity. It is an abstract concept prevailing within an organization or society. There are no direct ways of adjusting it. Safety culture is, however, a crucial concept for understanding the possibilities of prevention. One of the goals of this edition is to explore this new concept (Sklet, 2004).

Workshop accident is a situation which is free from danger or risk. With rapid advances in industrial processes newer types of dangers to life, limb and health are being increasingly introduced. In workshop exposure to risk involves either man, material or machines or any combination of these three and is reflected as unexpected or unforeseen occurrence that interrupts an activity. The loss due to accidents is colossal in the form of pain, loss of life, earning capacity. The pain and suffering of the injured as well as the emotional loss to the victims of the fatalities and accidents causing disfigurement or disabilities are impossible to be summed up or evaluated. Accident prevention must be taken seriously in workshop either on money loss basis or on humanitarian ground (Jain, 2013).

Accidents in the workshop mostly affect the worker directly. He is working directly under the supervisor who can stop or prevent him from doing the unsafe act, supervisors on the other hand can also rectify or get rectified the unsafe mechanical or physical condition prevalent on the shop. Supervisors play a key role in accident prevention on the workshops since he has the opportunity to prevent accidents, authority of the management and responsibility for safe production in area. He, on the other hand, can get guidance from his supervisors or safety officer to make his section most safe or free from accidents. It does not mean that supervisor is only responsible for accidents. The objective of accident prevention can be best achieved only if top management function of organization, planning, directing and controlling for ultimate objective of making accident free industry cannot be delegated and requires

sustained efforts to ensure success of accident prevention programme (Kjellen and Larsson, 1981).

In workshops, safety procedure is not complete or satisfactory if it does not provide for the guarding of machines, the provision of safe tools, adequate light, ventilation and sanitation and for the correction or elimination of other mechanical and physical hazards. The basic objective of machine safeguarding is to prevent personnel from coming in contact with any revolving or moving machine parts such as belts chains, pulleys, gears, flywheels, shafts and spindles and any working part of the machine which creates a shearing or crushing action or may entangle the worker (Jorma, 2008).

Some of the most helpful practices for preventing and avoiding workshop accidents include eliminating shortcuts, implementing emergency drills, and being aware of inherent job risks. You and your employees should remain on guard against any potential causes of accidents. Posting safety guidelines and unanimous participation in safety programs can make a big difference in eliminating workshop accidents (Jorma, 2008).

The objective of this study is to technically investigate on the causes and control of workshops accident and also to access the management involvement on the causes and control of workshop accidents. It is hoped that the findings of this study will provide a suitable means of preventing and controlling workshops accidents.

## **MATERIALS AND METHODS**

This study was conducted at Projects Development Institute (PRODA) Enugu in Enugu State. The employees of the establishment include administrative workers, Engineers, Technologist, Technicians and other staffs.

### **Study Area and Data Gathering Description**

The Projects Development Institute (PRODA) Enugu, a parastatal under the Federal ministry of Science and Technology, and it is located at Emene Industrial Layout, off Enugu/Abakaliki Expressway Enugu, Enugu State, Nigeria. The Institute's Management Committee is made up of six Heads of Departments and chaired by the Director General/Chief Executive Officer, who is responsible for the day to day running of the Institute. The institute has about 150 staffs. The manpower development efforts of the institute covers such areas as vocational training/skill acquisition, practical work experience

for students, graduate training for graduates, remedial courses, conferences, seminars and workshops.

The ever increasing mechanization, electrification, chemicalisation and sophistication have made industrial jobs more and more complex and intricate. This has led to increased dangers to human life in industries through accidents and injuries. In fact, the same underlines the need for and importance of industrial safety.

### **Method of Data Collection**

The method of data collection used includes personal interview with the workers and sample study of workers with the aid of a well-structure questionnaire. The author took a preliminary survey of working environment at Proda, Emene Enugu and this lasted for a day. On the second day, physical examination and monitoring of how machine operators and their supervisors handle their machines and tools at work. The engineers, technologist, technicians, supervisors, machine operators and other relevant staffs attached with machine were in the best position to give the required information by virtue of their position and experience.

### **Sample Study**

The author was able to issue 120 questionnaires to 120 staffs randomly and 118 questionnaires were recovered. The Institute's management committee is made up of six departments with almost six (6) places visited which include: (i) Materials science and technology, including metallurgy, foundry work, plastics and synthetic fibres. (ii) Processing of ceramic materials and other solid based minerals for industrial use, including development of ceramic, glass and mineral technology. (iii) Processing of local foodstuffs of economic value. (iv) Mechanical engineering including engineering design, fabrication, machining and other processes and Coal utilization. (vi) Electrical and electronic elements particularly electrical generators, motors, transformers and switchgear. (vii) Science laboratory equipment development including apparatus for teaching of the physical sciences and engineering.

Each of the places was issued 20 questionnaires randomly.

### **Design of Study Questionnaire**

The Questionnaire was designed in such a way as to provide information already outlined in introduction under objectives of the study. The questionnaire comprises the information regarding the bio data, causes of workshop accident and control of workshop accident. The

respondent suggestions were also sought as to the means of preventing or eliminating workshop accidents.

### **Questionnaire Administration and Problems Encountered**

The administration of the questionnaire to the respondents took almost a month. The questionnaires were not to be filled by any staff but those that are working with the machines. This made the administration a little bit difficult because most of the respondents were not free to respond to interview or to fill the questionnaire issued to them. The administration of the questionnaire was undertaken by the author and one other student of Enugu State University of Science and Technology, Enugu. Before the administration of the questionnaire commenced, the author briefed the student on how the questionnaires were to be administered.

Data gathering lasted for two weeks and an average of 60 questionnaires were administered in a week. Information on the staff size, availability of functional machines, how to provide necessary materials required in control of workshop accident were also gathered. Questions were also asked about the machine operators, level of education and experiences. Other information sought included the general suggestion on how to control workshop accidents.

### **RESULTS AND ANALYSIS**

The investigation survey was carried out from machine operators and other relevant staffs attached with machine at Projects Development Institute (PRODA) Enugu in Enugu State of Nigeria. The data obtained from the questionnaires issued and oral interview to the machine operators and other relevant staffs are shown in the tables below.

**Table 1: Educational qualification of the respondents.**

<b>Qualification</b>	<b>Number of Respondents</b>	<b>Percentage (%)</b>
Illiterate	4	3.4
FSLC	24	20.4
WAEC/SSCE	20	16.9
Graduate/HND	40	33.9
Above Graduate	30	25.4
Total	118	100

**Table 2: Number of Casualties in a Day.**

Casualties	Number of Respondents	Percentage (%)
1 -3	44	37.3
4 -5	8	6.8
Above 5	4	3.4
None	62	52.5
Total	118	100

**Table 3: Number of Casualties in a month.**

Casualties	Number of Respondents	Percentage (%)
1 -10	72	61.0
11 - 20	12	10.2
Above 20	6	5.1
None	28	23.7
Total	118	100

**Table 4: Number of Casualties in a year.**

Casualties	Number of Respondents	Percentage (%)
Below 30	58	49.2
30 - 40	42	35.5
41 - 50	8	6.8
Above 50	4	3.4
None	6	5.1
Total	118	100

**Table 5: The Causes of workshop Casualties.**

Causes	Number of Respondents	Percentage (%)
Wrong use of machine	64	54.2
Machine malfunctioning	28	23.7
Wrong layout of machine	16	13.6
Others	10	8.5
Total	118	100

**Table 6: Other Causes of Workshop Accident.**

Other Causes	Number of Respondents	Percentage (%)
Narrow passage ways	60	50.8
Rough Floor	30	25.4
Poor Ventilation	4	3.4
Noise Level	10	8.5
Others	14	11.9
Total	118	100



**Table 7: Management Response to Machine Malfunctioning.**

<b>Response from management</b>	<b>Number of Respondents</b>	<b>Percentage (%)</b>
Do the repair immediately	20	16.9
Neglect the repair	40	33.9
Replace worn out with new one	4	3.4
Ask the operator to manage it	54	45.8
Total	118	100

**Table 8: The management response to accident caused by operators.**

<b>Management response</b>	<b>Number of Respondents</b>	<b>Percentage (%)</b>
Punish an offender	16	13.6
Neglect the1 offender	6	5.1
Sack the offender	14	11.9
Caution an offender only	82	69.4
Total	118	100

**Table 9: The use of operational manual by the operators.**

<b>Use of operational manual</b>	<b>Number of Respondents</b>	<b>Percentage (%)</b>
Yes	98	83.0
No	4	3.4
Cannot say	16	13.6
Total	118	100

**Table 10: Using Protective cover when operating machine.**

<b>Using Protective cover</b>	<b>Number of Respondents</b>	<b>Percentage (%)</b>
Yes	104	88.1
No	14	11.9
Total	118	100

**Table 11: Workshop accident caused due to dirtiness.**

<b>Accident due to dirtiness</b>	<b>Number of Respondents</b>	<b>Percentage (%)</b>
Yes	80	67.8
No	38	32.2
Total	118	100

**Table 12: working in a workshop without light.**

<b>Working without light</b>	<b>Number of Respondents</b>	<b>Percentage (%)</b>
Yes	94	79.7
No	24	20.3
Total	118	100

**Table 13: Sources of light to the workshops.**

Light source	Number of Respondents	Percentage (%)
EEDC/PHCN	72	61.0
Solar System	8	6.8
Generator/Lister	34	28.8
Other	4	3.4
Total	118	100

**Table 14: Operators Adherence to safety precautions in workshops.**

Adhere to safety precaution	Number of Respondents	Percentage (%)
Yes	108	91.5
No	10	8.5
Total	118	100

**Table 15: Management provision of materials for control of workshop accidents.**

Provision of materials	Number of Respondents	Percentage (%)
Yes	46	39.0
No	72	61.0
Total	118	100

**Table 16: Grading of management on general control of workshop accident.**

Grading of Management	Number of Respondents	Percentage (%)
<b>Bad</b>	54	45.8
<b>Fair</b>	14	11.9
<b>Good</b>	34	28.8
<b>Excellent</b>	10	8.4
<b>Outstanding</b>	6	5.1
<b>Total</b>	118	100

### Analysis of Results

The staff of Projects Development Institute (PRODA) Enugu comprises both male and female of different years of experiences. The respondents that were given the author information include engineers, technologist, technicians, supervisors, machine operators and other relevant staffs attached with machines. The educational qualifications of the respondents were shown in table 1. The highest percentage of the educational qualification of the respondent was first degree holder, which is 33.9%, while the lowest percentage were illiterate that has 3.4%. This means that majority of PRODA staffs are educated.

The casualties recorded in the company from the respondents in a day, month and yearly were given in tables 2, 3 and 4 respectively. The highest percentage of casualties in a day was 52.5% that fall into none, which means that many injuries were not sustained in a day, while 61.0% of the respondent reported that 1-10 casualties were recorded in a month and 49.2%

showed that below 30 casualties were recorded yearly. This showed that an accident in that company was very small compared to productivity.

The results in tables 5 and 6 showed the causes of the accident in the company. The highest percentage of the respondents, which is 54.2%, reported that the wrong use of machine was the major cause of accident in the workshop and 50.8% claimed that narrow passage ways in the workshop contributed to the cause of accident.

The response from the management on the report of malfunctioning of machines in the workshop was recorded in table 7. The highest percentage of respondents, which is 45.8%, always asks the operator to manage the malfunctioning of the machine and the next to the highest percentage is 33.9% which say that they neglect repair entirely.

The results obtained by assessing the respondents on the management response on the accidents caused by the machine operators were shown in table 8. The highest percentage of the respondents, which is 69.4%, said that the management only caution an offender and allow them to continue with their work.

On tables 9, 10 and 11, the response of respondents on the use of operational manual, protective cover when operating machines and accidents caused by dirtiness of workshops were shown there. It was gathered that the highest percentage of 83% uses operational manual, while 88.1% uses protective cover when operating machine and 67.8% said that majority of the accidents were caused by dirtiness in the workshops.

The results on tables 12 and 13 show the respondents records on the use of lights and light source in the workshops. The higher percentage of 79.7% claimed that they work in the workshop with lights on while 20.3% said that they work without lights. Majority of the respondents, which has 61% claimed that the lights source was EEDC/PHCN and 28.8% said that generator or Lister was the source of light.

The results obtained on the adherence to safety precautions and management provision of necessary materials required for control of workshop accidents were shown on tables 14 and 15 respectively. The higher percentage of 91.5% agreed that they adhere to safety precautions while working in the workshops and 61% claimed that management do not provide all the necessary materials required for control of workshop accidents. This means that management contributed on the cause of workshop accident.

The respondent scoring of management on the control and check of workshop accidents was shown on table 16. The highest percentage, which is 45.8%, scored the management bad in control and check of workshop accidents. This results show that management has not been doing their work on the issue of workshop accidents control and prevention.

### **SUMMARY OF RESEARCH FINDING**

The outcome of data analysis and information obtained by the researcher yielded the following, that: Many of the machine operators were not trained on the use of machines and they don't have all the pertinent information relating to the task they are performing. Many of the respondents knew nothing about the causes of accidents, control or prevention in the workshops. A good safety culture is a work environment where all members of the organization share a high safety ethic, but the author found out that most machine operators, engineers and others attached to machine do not know much of cleanliness of workshops.

The author also discovered that management does not provide all the necessary materials required for control and prevention of workshop accidents. Also, they don't organize workshop, seminar or symposium on the safety tips, prevention and control as standard for controlling workshops accidents.

### **CONCLUSIONS**

Controlling and prevention of workshop accidents requires the concern of the management, government, Engineers, Technologist, Technicians, supervisors, etc. All these must be brought together by all the company management policy to reduce drastically the issue of workshop accidents. It was gathered from the study that the management contributes majority of the accident in the workshops. The researcher has also found that the highest causes of accidents in the workshops are the wrong use of machines, machine malfunctioning and the layout of machine in the workshops.

The author gathered that 45.8% of the respondent scored the management bad in control and check of workshop accidents while 28.8% scored them good. This means that management has not been doing their work on the issue of workshop accidents control and prevention. The averages of 1 – 10 casualties in a month and below 30 casualties in a year is too much, therefore, management should wake up to do their work on the prevention and control of workshop accidents.

The quickest way to get a job done is to do it right the first time. To do it right the first time, you need to make sure that you have any and all pertinent information relating to the task you will be performing. Workers, who begin a job with just half the information, or half the instructions, are essentially doing the job while blind. Remember this; it's not stupid to ask questions, it is stupid not to.

Due to the hazardous nature of the workplace, risk assessments need carrying out to ensure that staffs are protected from dangers that could cause them harm. All staff should have full health and safety training that teaches them the importance of being vigilant while using protective equipment.

Prevention, they say is better than cure. In essence, it is better to stop an accident from happening rather than trying to deal with the problem after it had happened.

### **RECOMMENDATIONS**

The following recommendations were made after gathering information from respondents through questionnaire and oral interview on the causes and control of workshop accidents at Projects Development Institute (PRODA) Enugu:

There is a need to strictly adhere to workshop safety rules and regulations and should be revisited from time to time.

The practices for preventing and avoiding workshop accidents include eliminating shortcuts, implementing emergency drills, and being aware of inherent job risks. You and your employees should remain on guard against any potential causes of accidents. Posting safety guidelines and unanimous participation in safety programs can make a big difference in eliminating workshop accidents.

Workshops can be very dangerous places and it is up to you to ensure that you keep it as safe as you possibly can. You need to ensure that all your staffs are up to date with safety precautions and that they understand all the safety rules. It doesn't matter whether you have a large workshop or a small home workshop, safety is important and there are some ground rules that you should always have in place.

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