COURSE GUIDE

HED 330
INDUSTRIAL HEALTH EDUCATION

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INTRODUCTION

Industrial Health is a level course prescribed as a requirement for the award of a degree. The course enhances students' knowledge and skills for industrial health education delivery in order to achieve improved knowledge, attitude and practice of disease prevention, accident avoidance as well as the promotion of wellbeing of workers in industrial establishments.

Industrial establishment is where some people earn their living and spend considerable number of hours per day. Workers are employed basically in industries to produce goods and services. In turn, the products of industries contribute to national economy. It is the expectation of the management of industrial establishments that workers produce maximally. However, hazard, disease and accident are identified problems that could constitute hindrances to maximum production of workers in industries. Therefore, it is important that the management and workers have the knowledge of these problems with a view to preventing them. The area of academic study that prevents health problem is health education. Health educators are saddled with the responsibility of delivering health education in academic institutions and industrial establishments. It is important therefore, that practicing industrial health educators and preservice teachers should be empowered with adequate knowledge of industrial health education.

The course introduces the students to historical development of industrial health as well as health hazards including diseases and accidents associated with industries. The course examines health strategies for protection and promotion of health of workers in order to increase their productivity and reduce man hour loss and health care costs.

WHAT YOU WILL LEARN IN THIS COURSE

Industrial health as a course will acquaint the students with concept of industrial establishment, industrial health concept as well as historical development of industrial health. In this course, common health problems such as diseases and accidents are examined, policies as well as agencies responsible for health and safety of workers in industries are treated. The course will help the students to appreciate the enormous work of industrial health in ensuring health promoting industrial establishment environment.

COURSE AIMS

The main aim of the course is basically to provide the learners with knowledge and skills for the promotion of health and safety of workers in industrial establishments.

COURSE OBJECTIVES

The objectives of the course as derived from the broad aim of the course are stated as follows:

1. Provision of historical development of industrial health.
2. Exposing learners to historical development of industrial health
3. Intimating learners with hazards associated with industries.
4. Identification of diseases that can result from production activities in industries.
5. Identification of gadgets and devices that can be used for protection against industrial hazard as well as limit exposure to hazardous substances in industries.
6. Acquaint the students with approaches to health education delivery in industrial establishment.
7. Equip the learners with principles and practices of measurement and evaluation in industrial health education.
8. Creating awareness on the existence of the constitutional provisions meant to safeguard the health and safety of workers in industries including enforcement bodies.
9. Equipping learners with knowledge for the purpose of initiating positive attitude in order to ensure good health practice.
10. Prevention of health problems in industries.

WORKING THROUGH THIS COURSE

Thorough reading of this course material, noting the salient points as well as paying attention to the details will help to comprehend. Students should endeavour to undertake all the assessment exercises diligently. Take a step further by reading additional relevant texts and recommended books and links.

COURSE MATERIALS

The main constituents of the course are:

i. Course Guide
ii. Study Units
iii. Other Resources

STUDY UNITS

There are 13 study units in this course divided into 5 modules. The modules and units are presented as follows:

Module 1 Concepts in Industrial Health

Unit 1 Concepts of industrial establishment and industrial health
Unit 2 Health education in industrial establishment.

Module 2 History and Development of Industrial Health

Unit 1 Historical background of industrial health.

Module 3 Industrial Health Hazards

Unit 1 Concepts and types of Industrial Health Hazards
Unit 2 Industrial health hazards identification: importance and process
Unit 3 Industrial Toxicology

Module 4 Industrial Health Problems

Unit 1 Social and Health Problems of Industrialisation
Unit 2 Diseases and Disorders in Industrial Settings
Unit 3 Occupational health related problems
Unit 4 Health problems of office workers
Unit 5 Carpal Tunnel Syndrome and Computer Vision Syndrome

Module 5 Prevention of Industrial Health Problems

Unit 1 Methods of Preventing Industrial Diseases and Disorders
Unit 2 Roles of government and international organisations in industrial health

REFERENCES/FURTHER READING

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ASSIGNMENT FILE

In this course there are two types of assignment. They are the Tutor Marked Assignment and a written examination. The course material

provides enough information for you to be able to do the assignments successfully.

TUTOR-MARKED ASSIGNMENT

This is the continuous assessment part of the course. It carries 30 percent of the total score.

Each unit will equip you with adequate knowledge to tackle Tutor Marked Assignments (TMAs)

FINAL EXAMINATION AND GRADING

The final examination concludes assessment for the course and constitutes 70 percent of the whole course.

PRESENTATION SCHEDULE

This course material has been prepared to supply you with adequate information about the course: Industrial Health. Facilitators will lead you through the course using this material. It is important that you complete the Tutor Marked Assignment and submit at the record of time without delay.

COURSE MARKING SCHEME

The marking scheme contains answers to questions prepared for final examination. Mark allotted to each question shall be clearly stated. Marking scheme will be strictly followed in marking students' script.

COURSE OVERVIEW

The course, industrial health exposes the students to concepts in industrial health, laying emphasis on industrial establishment, health education in industrial establishment, history and development of industrial health, industrial health hazards, industrial health problems, prevention of industrial health problems and roles of government and international organisations in industrial health. The experience of the course empowers students with knowledge and skill to deliver industrial health instruction in classroom and industrial settings.

HOW TO GET THE MOST FROM THE COURSE

Open and distance learning provides unique opportunity for learners to be architect of their own fortune. The learners can at his/her pace, time, rate and location study. The course material is what the learner

manipulates to get the most. More so, learner can evaluate himself/herself by attempting religiously the exercises provided at the end of each unit.

The items presented in each unit have been so arranged to make it convenient for learners to study. The pattern of presentation of each unit is similar, each one dovetailing to another. The topics are presented in such a way that each one leads to another. In the presentation of the materials, continuity is ensured as it helps the learner to reinforce the stability of learning and skill acquisition. The first item is an introduction to the topics of the units followed by behavioural objectives. This objective tells you the knowledge and skills to be acquired at the end of the study.

It is important that, on completion of the unit you should be able to ascertain that stated objectives have been achieved.

The followings are pragmatic measures to be followed in order to gain expected knowledge and skill from the course. However, the course material may not be able to take the place of your tutor completely as you will need assistance at one time or the other. I advise that when the need arises do not pause to approach him/her for the assistance.

1. Choose a location where you can get yourself organized and concentrate.
2. Schedule your study programme very well
3. Read and understand well the introductory part of this study material before proceeding to the units.
4. Do a thorough step by step reading of each unit without altering the arrangement.
5. While reading, pay particular attention to the stated objective. I assure you that they are attainable because they are behavioural.
6. After you are sure that you have a good understanding of the material in a unit, attempt the exercise at the end of each unit and submit to your tutor.
7. As soon as your assignment is returned marked go through the comments. Ask your tutor for possible assistance where you have problem.
8. Start another unit only after you have done necessary correction of the mistakes of the previous unit assignment submitted.
9. On the completion of the last unit go through the entire study material again. You need to have discussion group to compare ideas. Get yourself fully prepared for the final examination.
10. In order to prepare well for examinations, students should get writing materials (biro, pen, pencil, ruler etc.). ready and ensure that they are perfectly working.

FACILITATORS/TUTORS AND TUTORIALS

Provision will be made for teaching session to be given by your facilitators/tutors. During tutorials your difficult area will be attended to by your facilitator. Also, tutorial sessions will give you ample opportunity to ask questions and answers will be given by your facilitator.

SUMMARY

The course is prepared to equip the students with the knowledge and skill to enable them to function effectively in any role that the individual may be assigned in the areas of health and safety in industrial health.

MAIN COURSE

CONTENTS **PAGE**

MODULE 1 CONCEPTS IN INDUSTRIAL HEALTH

UNIT 1 CONCEPTS OF INDUSTRIAL ESTABLISHMENT AND INDUSTRIAL HEALTH

CONTENTS

1.0 INTRODUCTION

Industrial establishment is a place where close interaction among workers on one hand takes place and interaction between workers and machines including the entire environment on the other hand. Therefore, its safety is of concern as it is of paramount importance.

The unit exposes learners to concept of industrial establishment and industrial health. It helps the learner to describe what health education stands for in industrial establishment.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- Describe Industrial Establishment
- Define Industrial Health
- Explain Health Education in Industrial Establishment

3.0 MAIN CONTENT

3.1 Concept of Industrial Establishment

Industrial establishment is a place where goods are manufactured and services are rendered to consumers. Lawinsider (2020) described industrial establishment as a workshop or other establishments in which the work of making, altering, ornament, fishing or packing or otherwise treating any article or substance with a view to its use, sale, transport, delivery or disposal is carried on or where any such service is rendered to a consumer and include such other class or classes of establishments or government may declare to be industrial establishment.

Work that takes place in industries provides monetary gain, personal satisfaction and identity to workers. The gainful employment that results from industrial establishment helps to alleviate poverty in the society. Goods and services produced by industrial establishment contribute to the economy of a nation.

It is a known fact that the quality and quantity of goods and services produced by industries ensure sustainable economic development of a nation. However, maximal production of industrial establishment is a function of health and safety of workers including industrial environment.
In Nigeria, industrial establishment contributes to socio-economic development in the following ways:

(i) **Utilization of local raw materials**. Industries make use of locally produced raw materials to manufacture consumable goods and services. In this way industries provide opportunities for people in agriculture to sell their products for monetary gain.
(ii) **Internally generated revenue**: Industries are capable of increasing a nation per-capital income. This is because products of industries can be sold locally as well as exported to other countries of the world for improved earnings.
(iii) **Provision of gainful employment opportunities:** Industrial establishments do employ a large number of people to work in the production process. In this way people employed earn their living.
(iv) **Increased foreign earning:** Goods and services locally produced by industries sold to other countries can boost foreign exchange earning of the country
(v) **Encourages agr\ultural practices:** Many people can be attracted into agricultural sector when there is ready market for their products. Industries buy primary products in large quantities thereby encouraging farmers to produce more. The problem of

joblessness in the country can be solved using the instrument of agriculture only if young school leavers can be encouraged to go into agriculture.

(vi) **Boosting other sectors of the economy:** Industrial activities are capable of improving other sectors of the economy such as transportation, agriculture, commerce, communication, construction and education.

(vii) **Poverty reduction:** Nigeria is a developing country. Poverty is an important index of under-developed and developing countries of the world. People are poor by the reason of joblessness. They roam about the streets of urban areas in search of jobs that are non-existing and, in the alternative, they take to social vices for survival. Therefore, provision of gainful employment is an important strategy for poverty alleviation.

(viii) **Advancement of science and technology:** Industrial establishments use products of science and technology. This is because machine as well as tools are made through the efforts of science and technology. Research efforts towards major discoveries in science and technologies can be encouraged when the products are put into use.

(ix) **Enhanced international trade**: International trade is promoted through industrialization. The products of industries when exported carry higher value compared with when primary product is exported. Example is crude oil exported to be refined in foreign countries sells at lower price compared with the imported refined oil that carries higher value. Essentially, increased industrial products carry higher value thus promoting international trade.

(x) **Increased quality of life and healthy living**: Availability of quality goods and service through industrial activities can improve standard of living of the citizenry. In this way, people can enjoy good quality of life and healthy living. Goods and services produced by industries locally can be cheaper and available and affordable, hence they are highly utilized.

(xi) **Self-reliance in times of war**: According to Mehta (2010) in order to achieve self-reliance in emergency times, industrialization is necessary. He further said that during war and emergency, dependence on foreign countries for weapons may prove fatal. He concluded that self-reliance in capital goods and industrial infrastructure is necessary.

3.2 Industrial Health

Industrial health and occupational health are two words that one cannot but mention when discussing issues regarding the health and safety as well as wellbeing of workers. This explanation becomes pertinent in order to put the two concepts into proper perspective when discussing.

Davies (2021) defined industrial health as a branch of public health concerned with health and wellbeing of workers as it aims to eliminate hazard and reduce industrial fatigue. ILO/WHO (1950) defined occupational health as the promotion of and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations by preventing departure from health, controlling risks and adaptation of work to people and people to their jobs (Agius, 2010). In the functional definition of the two concepts similarities can be identified. The Joint International Labour Organisation Committees on Occupational Health (1950) concluded that industrial health care is preventive health care which is provided on the basis of the occupational health care Act (Mishra, Mishra and Yadav, 2012). This submission provides sufficient justification for the use of the two concepts interchangeably.

Industrial health is a collection of activities involving anticipation, detection, prevention and control of diseases and accident occurrences by the reason of risk of industrial work and its environmental condition. Oladipo (2003) described industrial health as the science of the anticipation, recognition, evaluation, and control of health hazards arising in or from the work environment with the objectives of protecting the health and wellbeing of workers, the surrounding communities and the general environment. Mishra, Mishra and Yadav (2012) reviewed the definition of industrial health given by the joint International Labour Organisation Committee on Occupational Health 1950 as the highest degree of physical, mental and social wellbeing of workers in all occupations. They further identified objectives of industrial health as: to reduce industrial accident; to prevent occupational hazards/diseases to achieve maximum human efficiency and machine efficiency; to maintain and promote the physical and social wellbeing of the workers and prevention of work-related diseases as well as the maintenance of employees working ability and functional capacity.

Hazards in industries are inevitable. This is because human error may occur, machine may suddenly develop fault and outbreak of disease may occur. Although the main goal of industrial health is to prevent hazard from occurring in industries but if it eventually occurs, adequate provision for it before it occurred can help reduce its effect to the barest minimum.

3.3 Goals and Objectives of Industrial Health

The main goal of industrial health is maintenance of the health and safety of the people while at work in the industrial environment. Arising from the broad aim, the following are the objectives of industrial health.

(i) To ensure that machines being used in industries are given highest -+p*ossible maintenance to prevent sudden development of fault.
(ii) To* ensure that workers are well prepared in term of technical skill 74acquisition to handle the job for which he/she is employed to do.
(iii) To ensure that workers perform their duties unhindered in the best possible safe and healthy environment.
(iv) Workers are well protected ensuring that they do not suffer any disability by the nature of their duty.
(v) Ensure that causes and costs of occupational injuries are reduced.
(vi) Ensure that work environment is health promoting such that it encourages high productivity.
(vii) Identification and substitution of hazardous materials in the industry.
(viii) Ensure that psychological and emotional needs of workers in industrial establishment are well attended to.
(ix) Early detection, diagnosis and managing work-related health problem.
(x) Ensure active participation of workers in the protection of their health e.g. utilization of personal protective equipment.

3.4 Importance of industrial health

The aim of Industrial health is the promotion of the health and safety of workers with the overall view of ensuring their general well-being in the industrial setting. The benefits which are accrued to workers as well as the management are enormous. Thus, multiplier effects of industrial health are enormous. This is because given a conducive environment to work the workers will work effectively to produce maximally because of good health he/she is likely to be enjoying. The increased productivity is to the benefit of the industry and by extension the management. A healthy and productive worker is always at peace with his/her family members, thereby ensuring family stability in the society.

The importance of industrial health programme cannot be over emphasized. The values of industrial health are briefed as follows:

1. Industrial health ensures health promoting industrial setting. In this way worker working in healthy environment will have low anxiety hence less aggression.
2. Industrial health improves productivity. A healthy worker will work vigorously and efficiently to produce maximally. This is because he/she enjoys good health which makes for high performances.

3. Industrial health provides industrial setting which helps to lower accident rates. It follows then that injury rate can also be brought to the barest minimum.
4. Industrial health provides an industrial environment that is satisfactory and stimulating. In this environment, achievement of job satisfaction can be ensured.
5. Industrial health provides industrial environment in which there is good interpersonal relation among workers. Worker-worker and worker-management relation can be said to perfect.
6. Industrial health provides worker who are well informed about the decision they take on their health. They are aware of hazard involved in their work and how to prevent them. Hence, they sustain less injury in their work place.
7. Industrial health provides industrial setting in which there is a reduced loss and wastages as a result of absenteeism on account of sickness.
8. In an industrial setting where industrial health is in place, machines and structures are well maintained. Personal protective equipment are made available and the workers are well aware of the need to utilize them for their protection.
9. Industrial health provides for Industrial environment where workers are physically, mentally and psychologically well-disposed as a result of effective management and stimulating environment.
10. In an industrial setting where industrial health is given a pride of place workers are well remunerated. Workers are well motivated to produce maximally through the instrument of high reward system.

3.5 Components of industrial health

Industrial health encompasses all the activities directed at ensuring health and safety of workers in their work places. The programme covers a large area of study hence so many professionals are involved. Professionals involved include industrial health educators, doctors and nurses, toxicologists, environmental health practitioners and safety engineers. Essentially, industrial health covers the following areas:

1. The industrial health and safety committee should be in place in all industrial establishments. The committee is saddled with the responsibility of initiating and planning activities in industrial health. The committee must be made to be functional. The committee conducts programme evaluation to identify areas that needs improvement. They co-ordinate all the activities including personnel involved in industrial health.

2. The health and safety regulation policy which is an instrument with which the occupation committee can work must be made available.
3. In industrial health, programme of activities includes monitoring and controlling health hazard specific to a particular industrial establishment.
4. In industrial health, provision is made for health examination of each worker before being employed. Also, periodic as well as special health examination are conducted.
5. First aid service is available in industrial health. This is important especially during emergency. First aid material including well trained personnel should be made available.
6. In industrial health there is provision for the health education and counselling. All the materials required by the designated personnel to carry out his/her duties effectively and efficiently should be made available.
7. In industrial health provision is made for personal protective devices. The health and safety committee ensures the provision of PPD by the management and utilization by workers.
8. In industrial health, provision is made for environmental hygiene and sanitary facilities. Appropriate disposal of waste is made provision for as well, in industrial health.
9. In industrial health provision is made for health service. Personnel as well as resources required should be made available.
10. In industrial establishment provision is made for report of cases of diseases, injury and death monthly, quarterly or yearly or annually or as deemed fit by industrial health committee.

3.6 Work-Health Nexus

Economic and social importance of work have continued to make it relevance in human life. Basically, work exist to produce goods and services for human consumption. In this way work serves as means of livelihood. The individual works to earn a living. Work, even if money is not involved can earn an individual personal gratification. The social benefit of work is that it shapes the identity of a person. The psychological gain from the work is that it leads to the achievement of self-worth, sense of belonging as well as self-actualisation. New and exciting experience of work make life more interesting to an individual. However, work can have a negative effect on a person. It can produce psychological effects on an individual. Work if not done in safe and healthy environment can lead to accident and ill-health.

3.7 Principles of Industrial Safety and Health

The achievement of the overall objective of industrial safety and health which is to ensure that work takes place in a safe and healthy environment is a task that must be done. This is because some industrial environments are not health promoting leading to occurrences of disease outbreak and accident, affecting health and productivity of workers. However, industrial safety and health can be effective only when it is based on sound principles. Key principles identified by Alli (2008) are briefed below:

- *All workers have rights*. Workers, as well as employees and governments must ensure that these rights are protected and must strive to establish and maintain decent working conditions and a decent working environment. More specifically:
  - work should take place in a safe and healthy working environment;
  - conditions of work should be consistent with workers' well-being and human dignity;
  - work should offer real possibilities for personal achievement, self-fulfillment and service to society (ILO, 1984).
- *Occupational safety and health policies must be established*. Such policies must be implemented at both the national (governmental) and enterprise levels. They must be effectively communicated to all parties concerned.
- *A national system for occupational safety and health must be established*. Such a system must include all the mechanisms and elements necessary to build and maintain a preventive safety and health culture. The national system must be maintained, progressively developed and periodically reviewed.
- *A national programme on occupational safety and health must be formulated*. Once formulated, it must be implemented, monitored, evaluated and periodically reviewed.
- *Social partners (that is, employers and workers) and other stakeholders must be consulted*. This should be done during formulation, implementation and review of all policies, systems and programmes.
- *Occupational safety and health programmes and policies must aim at both prevention and protection*. Efforts must be focused above all on primary prevention at the workplace level. Workplaces and working environments should be planned and designed to be safe and healthy.
- *Continuous improvement of occupational safety and health must be promoted*. This is necessary to ensure that national laws, regulations and technical standards to prevent occupational injuries, diseases and deaths are adapted periodically to social,

technical and scientific progress and other changes in the world of work. It is best done by the development and implementation of a national policy, national system and national programme.

- *Information is vital for the development and implementation of effective programmes and policies*. The collection and dissemination of accurate information on hazards and hazardous materials, surveillance of workplaces, monitoring of compliance with policies and good practice, and other related activities are central to the establishment and enforcement of effective policies.
- *Health promotion is a central element of occupational health practice*. Efforts must be made to enhance workers' physical, mental and social well-being.
- *Occupational health services covering all workers should be established*. Ideally, all workers in all categories of economic activity should have access to such services, which aim to protect and promote workers' health and improve working conditions.
- *Compensation, rehabilitation and curative services must be made available to workers who suffer occupational injuries, accidents and work-related diseases*. Action must be taken to minimize the consequences of occupational hazards.
- *Education and training are vital components of safe, healthy working environments*. Workers and employers must be made aware of the importance of establishing safe working procedures and of how to do so. Trainers must be trained in areas of special relevance to particular industries, so that they can address the specific occupational safety and health concerns.
- *Workers, employers and competent authorities have certain responsibilities, duties and obligations*. For example, workers must follow established safety procedures; employers must provide safe workplaces and ensure access to first aid; and the competent authorities must devise, communicate and periodically review and update occupational safety and health policies.
- *Policies must be enforced*. A system of inspection must be in place to secure compliance with occupational safety and health measures and other labour legislation.

3.8 Problems Associated with Industrial Health

Indicators of ineffectiveness of industrial health in industrial settings are widespread cases of diseases, accident occurrence in a large number, production low in quality and quantity, manifestation of poor interpersonal relationship, poor environmental sanitation, non-existing incentive, and non-provision and utilization of personal protective equipment.

The failure of industrial health can be attributed to the following factors:

1. Managements disposition to industrial health. Negative attitude of some managers of industries to industrial health has led to non-implementation of the programme. This is as a result of defective perception of industrial health as waste of resources.
2. A survey of socio-demographic characteristics of workers which showed that most Nigerian workers are poor illiterate constitute hindrance to industrial health.
3. Funding. Funding of industrial health whenever it is non-existing or inadequate, resource provision will be negatively affected. This can equally affect the implementation of the industrial health programme.
4. Staff Development Programme. Development programme for workers in an industry include, on the job training and retraining, opportunity for further education and of course attendance of conferences and seminars. When workers are denied the opportunity of attending seminars, they will not be acquitted with industrial health problems associated to new technologies and automation linked with biotechnologies.
5. Industrial establishment environment. The industrial environment that is not health promoting can constitute hindrance to effectiveness of industrial health.
6. Interpersonal relationship among workers. In an industrial establishment where acrimony, agitation and wrong accusation exist, industrial health may not be successful.
7. Poor cooperation, collaboration and coordination. Industrial health requires the input of many professionals. It follows then that when the activities are not well coordinated industrial health may fail.
8. Resources allocation: Personnel, equipment and facilities are main resources required to make industrial health effective. When the resources are not supplied or in short supply industrial health will be badly affected.
9. Dearth of technological infrastructure. The world at large is in the technological age. Most activities of human endeavour are now performed using technological devices. It can be difficult to monitor the health status of individual worker as well as environmental health condition of industrial establishment as part of activities of industrial health when required machine are not in place.
10. Prevailing socio economic and challenges of emerging new diseases. The challenges posed by new age diseases such as Human Coronavirus 2019/severe acute respiratory syndrome. Coronavirus 2 (SARS – COV -2/Coronavirus 2019 (COVID-19) and Human Immunodeficiency Virus (HIV) acquired

immunodeficiency syndrome (AIDS), in terms of stress, financial demand and over-stretched health care facilities are quite overwhelming on industrial health.

11. Social and economic problems in the society. People are going through stressful situation as a result of hike in prices of essential commodities, kidnapping and killings by bandits and change in weather condition due to climate change. All these have negative effect on human health. Industry is a microcosm of the society. It follows then that those industrial workers are also feeling the pains of the experience of the harsh socio-economic situation of the country. However, the social health problem is overwhelming on industrial health.

SELF-ASSESSMENT EXERCISE

What are the contributions of industrial establishment to socio-economic growth of a nation?

4.0 CONCLUSION

In this unit you learned concept of industrial establishment as well as industrial health. You have come to understand why health education should be given utmost attention in the programme of industrial establishment.

5.0 SUMMARY

This unit focused on the description of industrial establishment. Explanation of industrial health has been given in this unit as well.

6.0 TUTOR -MARKED ASSIGNMENT (TMA)

1. What are the contributions of industrial establishment to socio-economic growth of a nation?
2. Mention and discuss five (5) objectives of industrial health.
3. Discuss the place of health education in industrial establishment.

7.0 REFERENCES/FURTHER READING

Books

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UNIT 2 HEALTH EDUCATION IN INDUSTRIAL HEALTH

CONTENTS

1.0 INTRODUCTION

Health education in industrial establishment has continued to gain prominence perhaps due to increased awareness of the fact that prevention of diseases is cost effective compared to treatment cost. Employers and employees stand to gain from industrial health education. This is because pain resulting in physical and emotional suffering as a result of injuries and diseases can be averted. On the other hand, employees will experience a reduced spending on treatment of diseases and injuries. Also, efficiency and increased productivity will be recorded in industrial establishment to the amusement of managers of industries.

In this unit students will be taught industrial health education, objectives of industrial health education as well as principles of industrial health education. Need for industrial health education resources as well was evaluation of health education in industrial establishment are treated.

2.0 OBJECTIVES

By the end of this unit, you should be able to:

- Describe industrial health education
- State aims and objectives of industrial health education
- Mention principles of industrial health education
- State resources and materials for health teaching
- Mention steps in the evaluation of health education activities in industrial setting.

3.0 MAIN CONTENT

3.1 Industrial health education

Industrial health education is concerned with improving knowledge, attitude and practice of health and safety in order to achieve high level of wellness among industrial workers. Health cannot be achieved through wishful thinking. Rather, it is achieved by taking certain measures. Health education helps to identify these measures, encourage an individual to have positive attitudinal disposition towards the measures and get one convinced to put into practice the measures.

Health education is the composite learning experience organized to bring about voluntary modification of behaviour to facilitate the achievement of good health. It should however be realized that health educators work to facilitate the learning experiences that are programmed to bring about the strengthening of behaviour that are favourably disposed to health in a person, group of people or the entire community.

Teaching itself involves changing understanding, disposition and skill into a new practice. Practically, teaching and learning process entail exposure of a learner to an experience and close monitoring. Therefore, industrial health education efforts require the inclusion of teaching and learning process to encourage workers to adopt a behaviour that can facilitate attainment of good health in industrial establishments.

Health education brings to fruition all the activities directed at achieving health and safety of workers in industrial establishment. Educating workers on activities aimed at ensuring the development and maintenance of good health is an important welfare package that can boost efficiency and productivity. This is because only healthy workers can work at maximal capacity in order to increase productivity in the industry.

The area of study that provides knowledge for the purpose of positive attitudinal change in order to allow for possible good health practice is health education. In other words, sound health needed to enhance high productivity of industrial establishment for sustainable economic development of a nation can be achieved through the instrument of health education.

Health education brings to the understanding of workers the inherent dangers of their actions and inaction thereby becoming more careful in handling machines thus preventing accident. Health education identifies

the synergy between work and health. Physical exercise arising from work contribute to the fitness of workers.

In brief, health education is an instrument that can be used to educate the management and workers regarding their responsibilities at industrial establishments. The management in addition to provision of safe working environment should also endeavour to make available good tools as well as personal protective equipment. The workers in turn should avail themselves of the opportunity for adequate skill acquisition through attendance of training programme and adequate utilization of protective gadgets.

In fact, in an industrial establishment where health education is given a pride of place, workers will have job satisfaction while the industry will record high productivity.

3.2 Aims and objectives of industrial health education

The broad aim of industrial health education is to develop, improve, promote and maintain the health of industrial community members.

Specifically, the objectives of industrial health education are as follow:

(i) To provide industrial workers with knowledge of health facts and information in order to make informed decision about health.
(ii) To create awareness as to precautionary measures needed to ward off diseases and to ensure disease free industrial environment.
(iii) To enable workers to have the understanding of hazard associated with machines they operate every day and the industrial environment as well.
(iv) To bring to the awareness of the management awareness of their responsibility regarding provision of personal protective equipment for workers.
(v) To acquaint the workers with the need to utilize personal protective devices in order to safeguard their health.
(vi) To provide workers with basic knowledge of first aid.
(vii) To enable the workers to gain the knowledge of psychological and emotional problem that can have negative effect on their concentration at work.
(viii) To develop in workers' positive health habit that can prevent diseases.
(ix) To develop in workers such habit that can discourage smoking, alcohol use, substance abuse, uncontrolled sexual activity and sedentary life.
(x) To educate workers on the need to promote good personal relationship among workers.

3.3 Importance of Industrial Health Education

(a) Industrial health education provides workers with the knowledge of good health habit in order to ensure stable health.
(b) Industrial health education provides knowledge regarding the prevention and control of communicable diseases in industrial environment.
(c) Industrial health education helps to create awareness as to possible outbreak of disease in an industrial environment.
(d) Industrial health education provides knowledge about first aid that workers may need during emergency.
(e) Industrial health education equips workers with the knowledge of specific hazards associated with their work.
(f) Industrial health education provides the managers with the knowledge of their responsibility of providing safe industrial environment.
(g) Industrial health education acquaints the workers with the knowledge of the need to be responsible to themselves by utilizing personal protective equipment available in an industrial establishment.
(h) Industrial health education equips the workers with sufficient knowledge of negative effects of drugs, alcohol use and inactivity.
(i) Industrial health education provides workers with the knowledge of developing their physical fitness through healthy eating and participating in physical activity.
(j) Industrial health education makes workers to understand the importance of developing and maintaining good inter-personal relationship among industrial workers.

3.4 Principles of Industrial Health Education

Principles are basic rules that guide the operation of a system in order to achieve stated goals. Industrial health education has some fundamental principles that include the following:

(i) Industrial health education topics must be product of scientific discovery. They must be based on fact and figures already proved scientifically through research.
(ii) Topics in industrial health education must be of interest to industrial community members. The whole programme must enlist the interest of each and everyone in the industrial establishment.
(iii) Industrial health education must aim at solving the immediate and future health problems of the industrial establishment. A programme directed at solving the problems of concern to person

and community as a whole is capable of enlisting the interest of all.

(iv) Health education programme in industrial establishment must be well planned for easy execution. At the planning stage consideration must be given to available resources in term of money, personnel and materials. The population for which the programme is meant for must be clearly identified. Their demographic as well as their social and economic characteristics must be determined. The time and place of meeting must be identified and known to learners well ahead. A well planned and organized health education programme is most likely to achieve its aims and objectives.

(v) Industrial health education topics must be based on the needs of members of the industrial community. Two types of needs can be identified. The felt needs which are wants, hope and wishes. They are associated with issues, changes and results which are considered necessary for worker's life. Real needs are those things workers need to develop or utilize that leads to achievement of results desired.

(vi) Industrial health educator must try within his/her maximum effort to ensure that industrial community members participate in industrial education programme. Members of the management and all categories of workers must be involved. This is because the issue of health is of paramount importance to everybody that desires good health.

(vii) Industrial health education should respect the culture and customs of individual workers. Each culture must be recognized, appreciated and given due consideration when choosing topics as well as when teaching topics.

(viii) Even though the issue of health is of concern to all, cutting across all divides including religion. Industrial health education should respect religious belief of each and every one of industrial community.

(ix) Industrial health education should give due recognition to administrative structure in each industrial establishment. Line of authority that obtains in the industry should be strictly followed when handling administration issues.

(x) Assessment of progress made through the activities of industrial health education should be done from time to time. Evaluation of the whole programme of industrial health education should be conducted yearly. Report of the findings must be communicated to the management to serve as feedback for future improvement of programme.

3.5 Need for Industrial Health Education

Nigeria is a developing country fraught with many health problems and by extension industrial establishments have their share of disease and accident burdens which are preventable through industrial health education

(i) The widespread cases of preventable diseases such as malaria, cough, tuberculosis, HIV/AIDS abound in industrial establishment. In most cases personal hygiene, environmental sanitation and lifestyle modification can help to prevent the problems. Knowledge of preventive practice can be gained by workers through industrial health education.

(ii) Lifestyle that is at variance with good health is common among industrial workers. Such behaviour as smoking, abuse of drug, alcohol drinking, inactivity, sexual promiscuity and poor eating are significant causes of diseases. Change in lifestyle can help to prevent the health problems. However, the awareness of the needed change and how to go about it can be learnt through industrial health education.

(iii) Incidences of accident in industrial establishment are as a result of faulty machine and failure to use personal protective equipment by workers. Attitude that is in agreement with the utilization of personal protective equipment can be brought about by increased knowledge. Industrial health education is area of academic study that is responsible for the provision of health knowledge for the purpose of positive attitudinal change.

(iv) Poor concentration as a result of psychological problem and emotional instability at work by workers is a major cause of poor handling of machine leading to accident occurrence. Industrial health education is a potent instrument that can be used to restore emotional stability among workers if given a pride of place in industrial establishment.

(v) The emergence of non-communicable diseases as a major public health problem has given prominence to prevention as major solution to health problem. In this way, the truism that prevention is better than cure is brought to the fore. Incidentally, the core function of industrial health education is prevention of health problem even before it starts.

(vi) Environmental health conditions in some industrial establishments in the country is poor. Meanwhile unhygienic environment can cause disease. Poor attitude to environmental sanitation often led to unhygienic practices among workers. Industrial health education can be used as an instrument to change the unhygienic attitude of the workers.

(vii) Poor nutritional practices are common among industrial workers. People continue to eat junk food with little or no nutritional value. Such nutritional health problems as diabetes mellitus, obesity, cancer, cardiovascular diseases and hypertension continue to increase. Industrial health education in which nutritional health education will feature prominently is urgently needed to address the problem.

(viii) Climatic change has brought with it irregular rainfall and other environmental hazards. The consequences are overwhelming on human health including industrial establishment workers. Climate change is as a result of human action and inaction. Better attitude towards the environmental health practice can be enhanced through industrial environmental health education.

(ix) Workers spend a considerable proportion of the day in industrial premises where they are exposed to various forms of hazards including emotional stress and strains. These could lead to unsatisfactory emotional state if adjustment is not taking place simultaneously. The basic knowledge necessary in the event of accident or sudden illness can be presented to workers through industrial health education.

(x) Tension, stress and social change characterize day to day activities in industries. It is only industrial health education that can provide total fitness necessary to cope.

3.6.1 Methods and Materials in Industrial Health Education

The literary meaning of method is, organized, orderly and systematic way of achieving a predetermined goal. Thus, a given task can be completed by means of different ways. Specifically, teaching method in health education is a systematic plan for presentation of instruction and health material. The identified methods of health instruction are as follows:

(i) **Counselling method:** Counselling session provides opportunity for effective teaching of health education. This is because it allows for individualization of instruction, regarding personal health problems. This method is valuable in assisting concerned workers to discuss their personal health problems and the course of action necessary for a solution.

(ii) **Group discussion method**: Discussion provides ample opportunity for the exchange of information among workers. Workers can be grouped to unit or department to discuss health issues of common interest. Participants are encouraged to think and build up courage in order to contribute meaningfully.

(iii) **Lecture method**: In this method the health instructor gives verbal presentation of the subject matter. The method can be

used to introduce new material, to summarize the topic and present a large volume of content in a short time.

(iv) **Individualization as teaching method**: Individualization instruction is possible and desirable because interest and needs of workers with special difficulties can be met. The method allows the health instructor to give adequate attention to workers with special health issues.

(v) **Guest speaker as a method**: Guest speaker can be used to assist health instructor or in providing information in specialized areas. Guest speaker invited must be an authority in his/her field and represent a reputable agency. The use of guest speaker can arouse the interest of the learners.

3.7 Health Education Resources and Materials

Teaching materials are such things that can be manipulated, shown, identified and analysed and can contribute to spoken words. Teaching materials when used effectively can contribute to learning experiences. Essentially teaching materials are important medium of communication. Material aids appeal to such senses of touch, sight and smell. The use of materials aid to teach health topics stimulate the interest of learners.

In industrial establishments there may not be time and space for formal health education class to take place hence health instruction relies heavily on the use resources and material to convey health messages.

Some resources and material identified for teaching health education topics are as follows:

1. **Pamphlet:** A pamphlet is a leaflet containing information about a single subject. They are mainly used to provide current happening in a particular subject area in the society. Current information concerning health problem in an industry can be disseminated using pamphlets.
2. **Charts and posters:** Charts are a graphical representation for data visualization while poster is a large printed sheet that often contains pictures and is posted in a public place purposely to promote an health concept. They both serve to make available a wide variety of detailed information available for instant use. Essentially, they have good instructional value especially in strengthening information and ideas that should not be ignored. Examples of health-related chart are pictorial representation of COVID-19 prevention protocols. Posters that display eye catching illustrations and slogan e.g.," if you drink don't operate machine" to present ideas at a single glance.

3. **Bulletin board:** Bulletin board provides a suitable place to display various materials conveying health information. Items may be posted by workers and health instructor on health-related matters of interest.
4. **Photographs, still pictures and filmstrips:** Photograph of health importance can be pasted on the bulletin board and can be used for individual study or used to explain point during oral presentation. Still pictures can also be used to illustrate point either directly or through the use of the opaque projector. A filmstrip is a spooled roll of 35mm positive film with appropriately fifty images arranged in a sequential order. Filmstrip can be adapted to accommodate a variety of needs because they can provide their own narration.
5. **Videotape and cassettes:** During break time or any free time for industrial workers, common room television presentation can be made available. Programmed broadcast on health-related matter by public service network on radio and television can be recorded for later use.
6. **Supplementary books, magazines and periodicals:** Supplementary books and magazines that provide health information on wide variety health topics can be displayed in staff common rooms for workers to read. Also, periodicals that are health based do provide latest information regarding health issues. They can also be made available for industrial workers to read during their free times while relaxing.
7. **Motion picture:** Motion pictures also called film or movie are series of still photographs on film, projected in rapid succession onto a screen by means of light. They can be used to stimulate experiences that communicate ideas, perception and feelings. They can be used to record events from other countries to be viewed by workers at the comfort of their offices. Hence, documentary film that present complicated laboratory demonstration that are too difficult and expensive can be used to explain to workers the various health concepts and issues.
8. **Flannel board and magnetic board:** Flannel board is a visual aid used in teaching health topics. It is a board covered with flannel to which pictures, diagrams will stick when pressed on. It is valuable in illustrating a series of activities in a discussion period. Magnetic boards are metal sheets to which either magnetic pieces or materials attached to magnets will adhere. They can be used to pass useful health information to workers in an industrial establishment.

3.8 Evaluation of Health Education in Industrial Establishment

Health education provides information in critical health matters. It is an organized learning experiences for workers aimed at improving knowledge and attitude for better health practice in order to achieve health and safety.

Evaluation provides a systematic method to study a programme, practice intervention, or initiative to understand how well it achieved its goals (RHihub, 2002). Industrial health education evaluation is the process of using a standard in understudying the health education activities to determine the progress made towards the achievement of a predetermined objectives. The evaluation benefits industrial establishment immensely. It provides information about health education activities which can be used to ascertain basis for modifying the programme for the purpose of improving it.

The evaluation devices identified by experts that can be used in health education are as follows:

1. **Achievement test:** Achievement test measures what a learner has learnt as a result of an instruction given or training. It can be administered orally or in written form.
2. **Observation schedule:** It is an instrument with which events are been observed and recorded as they occurred. The use of the instrument requires that the instructor be precise, discriminatory and critical.
3. **Questionnaire:** It is an instrument used to collect responses to questions about the respondents' health practices. Information about the personal health concern can be collected using questionnaire.
4. **Checklist:** Checklist as a measuring instrument presents a list of health items, events or health behaviour recorded as they occurred. The use of checklist gives room for the recording of occurrences of an event as observed. However, the accuracy of the recording depending largely on the expertise of the health instructor.
5. **Interviews:** An interview is a written guide for asking questions in order to collect information from him/her about himself/herself or a system he/she is used to (Okpala, Onocha and Oyedeji, 1993). Interview can be used to collect vital health information from a person even if an individual cannot read or write. Also, as a result of close interaction brought about by interview, robust health information can be collected.

6. **Logs, diaries and reports:** Logs, diaries and reports are written accounts of significant events and reactions of people towards an event, while logs and report serve the purpose of keeping reports on other people; diaries serve the purpose of keeping self-reports (Okpala, Onocha and Oyedeji, 1993). Logs, diaries and reports can be used effectively to collect information about individual worker. Report of health-related happenings in an industrial establishment whether incidental or developed for special purposes can supply important data for accurate judgement of an individual's health status.
7. **Records:** Health record of individual such as age, weight, height, immunization received, result of X-ray and defects recorded as well as findings of period health examination can represent source of information.

Open University (2020) identified three types of evaluation in health education.

1. **Process evaluation:** It is concerned with assessing the process of health education implementation and how the work takes place. In process evaluation, health instructor evaluates the progress of work performance – whether the planned activities are cost effective and run as scheduled. Process evaluative can guide one to make changes to maximize effectiveness and efficiency.
2. **Impact evaluation**: Impact is an immediate effect or change produced by an intervention. In health education, these immediate changes may include changes in awareness attitude, beliefs, skill or health related behaviour. Impact evaluation refers to assessing the immediate effects of health education activities on the people who received health education messages.
3. **Outcome evaluation**: Outcome refers to the long-term changes that may have occurred as a result of health education interventions. These long-term changes may include decreases in mortality, morbidity, the prevalence of diseases or the incidence of health condition being studied. Outcome evaluation involves an assessment of some of these measurable, long-term outcomes or effects of health education activities conducted in the industrial establishment.

Furthermore, Open University (2020) mentioned steps in the evaluation of health education activities to include:

1. **Involvement of people to participate in health education evaluation activities:** Evaluation cycle should start by engaging all occupational health committee members including the

management team of the industry in the evaluation activities. Involving people that matters in the evaluation activities makes the result obtained to be widely acceptable in the industrial establishment.

2. **Description of the activities to be evaluated**: In order to carry out an evaluation, health instructor needs to describe the activities being evaluated in details. This will enable him/her to determine the objectives, activities, methods and materials as well as the context of the messages used in the activities being evaluated. In doing so one will be able to focus on what has been achieved.
3. **Selection of methods.:** In this step there is need to select methods to use. One can select observation, interview or any other method already mentioned depending on what one wants to evaluate. Health education instructor needs to prepare all resources required for the conduct of the evaluation.
4. **Collect credible data:** The data collected in order to conduct evaluation is the most important. This is because credible data makes for credible result. The method used should be appropriate and sufficient to give one the information one needs to know.
5. **Analysis of the data:** Once data have been collected from various sources the next step is to analyse and interpret the data. Analysis involves presenting the information collected in such a way that it gives meaning.
6. **Learn from evaluation**: The last step in evaluation deals with judging one's achievement. In this step evaluator should look at the extent to which he/she has achieved stated objectives, particularly behavioural and learning objectives. If the achievement is encouraging and one appears to have done the right thing, then it demonstrates that the methods, material and the messages used have probably worked. So one can learn from the evaluation and should be able to replicate the approaches used in the future health education activities.

According to Open University, 2020 on the other hand, the evaluation findings may tell one that things have not been done so well. This could mean that the evaluator has not achieved only a portion of stated behavioural and learning objectives. The evaluation findings should not only tell one the extent to which one has achieved objectives stated, but also the possible reasons for one's failure. This is certainly one of the basic purposes of conducting evaluation.

SELF-ASSESSMENT EXERCISE

State any five importance of industrial health education.

4.0 CONCLUSION

In this unit you have been taught concept of industrial health education aims and objectives of industrial health education including principles of health education.

5.0 SUMMARY

This unit focused on the description of industrial health education. Also, aims and objectives of health education are stated. Industrial health education should be given a pride of place in industrial establishment programme given its stated importance in industries.

6.0 TUTOR -MARKED ASSIGNMENT (TMA)

1. Describe Industrial health education.
2. Write five objectives of industrial health education?
3. State any five importance of industrial health education.

7.0 REFERENCE/FURTHER READING

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MODULE 2 HISTORY AND DEVELOPMENT OF INDUSTRIAL HEALTH

Unit 1 Historical background of industrial health

CONTENTS

1.0 INTRODUCTION

The study of historical development of industrial health from ancient times to the present era is an important step towards making a good preparation for the improvement of the programme in the future. Therefore, this unit examines the historical development of industrial health in the ancient times as well in United Kingdom and United States of America. It also looked at the development of industrial health in Nigeria. An attempt was made to explore the future trends of industrial health.

2.0 OBJECTIVE

By the end of this unit you should be able to:

- narrate the historical development of industrial health in the ancient times
- describe historical development of industrial health in United Kingdom and United States of America
- explain the historical development of industrial health in Nigeria

3.0 MAIN CONTENT

3.1 Historical Development of Industrial Health in the Ancient Times

Work is as old as humanity. This is because the survival of human being depends on food produced through work. The relationship between work and health is well established. Work makes some demands on human body. Job demands refers to physical and/or psychological effort or skill necessary for the achievement of organisation goal and are associated with certain physiological and psychological cost (Bakker and Demenrouti, 2007). Mente (2019) succinctly put it that occupational health focuses on measuring and managing the impact of work on a personal health and of a person's health and their ability to work.

The awareness about industrial health in the ancient times came through the efforts of spirited personalities and organisations. Ancient history is the aggregate of past events from the beginning of writing and recorded human history and extending as far as post-classical history (Wikipedia, 2020). Health and safety movement actually continue with the days of Babylonian. Around 2,000 BC Hammurabi the ruler of ancient. Babylonians developed code of Hammurabi. The code encompassed all the laws of the land at that time, showed Hammurabi to be a just ruler, and set a precedent followed by other Mesopotamian kings. The significance of the code from the perspective of safety and health is that it contained clauses dealing with injuries, allowable fees for physicians and monetary damages assessed against those who injured others. This clause from the code illustrates Hammurabi's concern for the proper handling of injuries (Pearsonhighened, 2018). Hippocrates who lived between 460 BC to 370 BC was an ancient Greek physician and regarded as frontier of medicine observed Lead poisoning in miners (Mente, 2019). According to Stanton (2017) Giaus Pliny Securus (2010) popularly known as Pliny the Elder who lived between 23 AD to 79 AD discussed the health and safety hazards of mining in Roman times mentioning miners being crushed to death from underground rock falls, the galleries filled with suffocating vapour and smoke, and the cloud of dust of a density quite incredible. Like Diodorus, he mentioned, the association of gold with quartz: the gold that is extracted from shaft. It was found to be adhering to gritty crust of marble. It is seen interfaced with the molecules of the marble. He commented that inhalations in silver mines were dangerous and on the presence of some fatal substances in deep-sunk wells that could be guarded against letting down a lighted lamp and ascertaining whether the flame was extinguished. Furthermore, he reported that the natural notorious or flammable gases in mines galleries were supplements by the gases

smoke from fire set to heat the rock and prepare for splitting with liquid. To overcome the problem of increasing heat with depth smoke and toxic gases the Romans created additional air movement through convention, so that warmer air from mine rose and was replaced by good air from outside.

Paracelsm who lived between 1493 to 1514 gave in his many lectures on the warning about the toxicity of mercury and sulphur. Geogina Agricola who was a German scholar in 1556 wrote a book titled "De Re Metalica". In the book he stressed the need for mine ventilation and mask for miners. He also included in the book some warnings about the toxicity of mercury and sulphur. Also, Bemardiro Ramuzzini an Italian physician who wrote a book he named "De Morbis Artificum Diatriba" which he published in 1700 where he described silicosis in pathological term as observed from the autopsies of the body of miner, he discussed extensively the importance of industrial hygiene in the prevention of many industrial accidents and diseases. He further explained the need to ask patient their occupations whenever they come for treatment and in accident. It was later included in almost every case history of patient (Osanyingbemi, 1987).

3.2 Historical Development of Industrial Health in United Kingdom

The United Kingdom, made up of England, Scotland, Wale and Northern Ireland, is an Island nation in the northern Europe. The core of the United Kingdom as a unified state came into being in 1707 with the political union of the kingdoms of England and Scotland into a new Unitary State called Great Britain. London is the capital city and globally influential centre of finance and culture.

The United Kingdom was the first to industrialise; its Industrial Revolution is said to have begun around 1760 in Abraham Darby's foundries at Coalbrookdate in The Bridge George, Shropshire and by the end of the Eighteenth Century it was rapidly gathering momentum as the mechanisation of production embraced the growing textile town. By this time general population was shifting from old rural agricultural economy to new industrial towns (Eves, 2014). According to Eves (2014) around 1860s there was serious concern about the high death rate from lung diseases in certain industrial occupations which led to an inquiry into the causes by Sir John Simon, Chief Medical Officer of the Privy Council who declared that 'The canker of industrial diseases gnaws at the very root of our national strength' The factory Act of 1864 included a requirement that in such a manner as to render harmless, so far as is practicable, any gases, dust or other impurities generated in the course of manufacture, that may be injurious to health. Almost fifty

years after Dr Thackrah of Leeds had made his suggestion, section 36 of the 1878 Act at last required exhaust ventilation by means of a fan for the removal of dust likely to be injurious to health. The Act also empowered inspector to require better sanitary conditions. Children and young persons were prohibited from employment in certain industries and processes such as silvering of mirrors by mercurial process.

Mente (2019) recorded that industrial revolution that took place between 1760 to 1840 brought about a huge rise in work-related accident and illnesses and the following key events occurred:

1775- The first occupational link to cancer was found (cancer was linked to high exposure to sun)

1831- Charles Turner Thackrah, a pioneer in the field of occupational health wrote "The effects of the Principal Arts, Trades and Professions and of Civic States and Habits of Living on Health and Longevity": with a particular reference to The Trades and Manufacturers of Leeds and suggestion for the removal of many of the agents which produce disease and shorten duration of life; showing how interest and knowledge of occupational health was growing.

1833 Onwards– Different industries were having inspectors appointed for the first time. For example, in 1833, the first factory inspectors were appointed, in 1843, the Mines inspectorate was formed to investigate and improve working conditions in mining industry and in 1895, The Quarry Inspectorate was formed.

Sir Thomas Morrison who lived between 1863-1932 was a medical doctor. He was appointed the first British medical factory inspector. He introduced the idea of occupational disease notification especially Lead where he stressed the preventive aspects of occupational health practices known as Legge's aphorism. (Adeniran, 2016). Aguwa (2013) stated three of the five Legges' aphorism as follows:

-First aphorism: Unless and until the employer has done everything and everything means a good ideal – the workman can do next to nothing to protect himself, although he is naturally willing enough to do his shares.
-Second aphorism: If you can bring an influence to bear external to the workman (.e., one over which he can exercise no control) you will be successful; and if you cannot or do not, you will never be wholly successful (Adeniran, 2016).

-Third aphorism: practically, all industrial Lead poisoning is given to the inhalation of dust and fumes if you stop their inhalation, you stop the poisoning (Adeniran, 2016).

-Fourth Aphorism: All workmen should be told something of the danger of the material with which they come into contact and not be left to find it out for themselves – sometimes of the cost of their lives.

-Fifth aphorism: Examples of influence – useful to a point but not completely effective- which are not external but depend on the will or the whim of the workers to use them, are respirators, gloves, goggles, washing conveniences and water proof and sand paper.

The idea about evolving an international occupational health care. This thought gave birth to the International Labour Organisation in 1919. The main function of ILO was safety and health of all types of workers especially from chemical and other industrial tasks, hygiene of seamen, social and medical insurance systems and workman's compensation. ILO sets international labour standard in order to advance social justice and promote decent work and decent treatment of workers. Around 1950s regulations and legislation became the focus of industrial health. Therefore, in 1956, the agriculture (Safety, Health and Welfare Provisions) Act was introduced covering health protection for agricultural workers and for children who may come into contact with agricultural equipment. According to Mente 2019, in 1974, The Health and Safety at work etc. Act 1974 was released, and this is the primary piece of legislation covering occupational health and safety in Great Britain; also in 1974, the Health and Safety Commission was established. Health and Safety Executive was formed in 1975. The Health and Safety Executive (HSE) provides information and advice, raise awareness, operate licensing activities in hazardous industries, carry out inspections and take enforcement action to prevent harm and hold those who break the law to account.

Since then, large amount of legislation has been put in place (with many changed or updated), including the Notification of accidents and Dangerous Occurrences Regulations 1980. Health and Safety (First Aid) Regulations 1981 Control of Individual Major Accident Hazard Regulation 1984. Reporting of Injuries, Diseases and Dangerous Occurrences Regulation 1985; Noise at Work Regulations 1989. The Management of Health and Safety at Work Regulations 1992. (Mente, 2019).

3.3 Historical Development of Industrial Health in United States of America

The United States of America was created on July 4, 1776 with the Declaration of Independence of Thirteen Colonies in the Northern America. United States of America can be said to have started on account of winning a revolutionary war. However, Industrial

Revolution is a complex set of economic, technological and social changes that occurred over a substantial period of time (United States Legislation Information 2017). According to United State Legislation Information (2017) Industrial Revolution came near the end of the eighteenth century, when Samuel Slater brought new manufacturing technologies from Britain to the United States and founded the first U.S. cotton mill in Beverly, Massachusetts. The technological innovation that would come to mark the United States in the nineteenth century began to show itself with Robert Fultor's establishment of steamboat services on the Hudson River. Samuel F.B. Morse invention of the telegraph and Elias Howe's invention of sewing machine all before the Civil War. Following the Civil War increase at a break neck pace. This period, encompassing most of the second half of the nineteenth century, has been called Second Industrial Revolution or The American Industrial Revolution. Over the first half of the century the country expanded greatly, and the new territory was rich in natural resources. Completing the first transcontinental rail road in 1869 was a major milestone, making it easier to transport people, raw materials and products. The United States had vast human resources between 1860 and 1900, fourteen million immigrants came to the country, providing workers for an array of industries (United State Legislation Information, 2017).

During the Industrial Revolution, child labour in factories was common. The hours were long, the work hard and the conditions often unhealthy and unsafe (Pearsonhighened, 2018). When the industrial sector began to grow in the United State, hazardous working conditions were common place. Following the civil war, the seeds of the safety movement were sown in this country. Factory inspection was introduced in Massachusetts in 1867. In 1968, the first barrier safeguard was patented. In 1869, the Pennsylvania Legislature passed a mine safety law requiring two exists from all mine. The Bureau of Labour Statistics was established in 1869 to study industrial accident and report pertinent information about accidents (Pearsonhighened, 2018). In 1877 Massachusetts Legislature passed a law requiring safeguards for hazardous machinery. In 1992 the first rewarded safety programme was established in a Juliet, Illinois Steel. Plantin response to a scare caused when a flywheel exploded, following the explosion, a committee of managers was formed to investigate and make recommendations. The committee's recommendations were used as the basis for the development of a safety programme that is considered to be the first safety programme in American industry. In 1907 the United States Department of the Interior created the Bureau of Mines to investigate all accidents, examine health hazards and make recommendations for improvements. Mining workers definitely welcomed this development, since more than 3,200 of their fellow workers were killed in mining accidents in 1907 alone.

One of the most important development in the history of the safety movement occurred in 1908 when an early form of workers' compensation was introduced in the United States. Workers' compensation actually had its beginnings in Germany. The practice soon spread throughout the rest Europe. Workers' compensation as a concept made a great stride in the United States when Wisconsin passed the first effective workers' compensation law in 1911. In the same year, New Jersey passed a workers' compensation law that withstood a court challenge. When the workers' compensation concept was first introduced in the United States, it covered a very limited portion of the workforce and provided only minimal benefits. Today, all the states have some forms of workers' compensation that requires the payment of a wide range of benefits to a broad base of workers (Pearsonhightened, 2018).

Most Legislations promoting workplace safety were passed in 1960s, for instance, The Service Contract Act, the Federal Metal and Non-metallic Mine Safety Act, the Federal Coal Mine and Safety Act and the Contract Workers and Safety Standards Act. Occupational Safety and Health Act of 1970 and the Federal Mine Safety Act of 1977. Occupational Safety and Health Act represent the most significant legislation to date in the history of the safety movement. During the 1990s, the concept of total safety management (TSM) was introduced and adopted by firms that were already practicing total quality management (TQM). TSM encourages organisations to take a holistic approach to safety management in which the safety of employees, processed, and products is considered when establishing safe and healthy work practices. At the turn of the century, health professionals began to show concern for workplace violence including terrorism. In addition, the twenty-first century saw a trend in which older people were returning to work to supplement their retirement income. This trend led to a special emphasis on the safety and health of older workers. The Superfund Amendment and Reauthorization Act was passed by Amended Clean Air Act in 1990, both were major pieces of environmental legislation. Another milestone that occurred in the decade of the 1990s was the trend towards safety professionals making ergonomics part of their overall approach for preventing accidents and injuries.

3.4 Historical Development of Industrial Health in Developing Countries

Developing countries are countries where industrial base is less developed. There industries are crippled by occurrences of preventable diseases and accidents. Significant differences between developed and developing countries exist. This is because in developing countries people are exposed to more than 80% of global hazards and according to

World Bank (1995) a factory worker in Pakistanis eight times more likely to be killed at work than a factory worker in France, fatality among transport workers in Kenya are ten times than those in Denmark and construction workers in Guatemala six times more likely to die at work than their counterparts in Switzerland (Khan, 2013). Occupational health identified contributory factor to diseases outbreaks and accident occurrence, determine measures to be taken to prevent illness by the reason of work, put in place appropriate control measures to prevent sickness, ensure that disability or impairment do not keep away people from work to earn their legitimate living wages, to ensure that people are fit to perform their job for which they are employed to do and finally ensure provision of health education and counselling to keep workers stable emotionally and psychologically. According to Asuzu, (1996) key elements in improving workers' health and safety, regardless of the level of development, include regulatory and enforcement framework, workers, employer and health professional education, surveillance and reporting systems, dissemination and implementation of best practices (Asuzu, 1996).

According to Asuzu (1996) in West Africa, as in most of the developing world, occupational health and safety practice came to us mostly as side products of the colonial company health work, in their attempt to fulfil the requirement of their national health laws to their citizen here. He further said that the first organized effort to boost occupational health and practice for the Africans among the Africans, and involving mainly Africans came in the 1960s with the first African Conference on occupational health in Africa in 1968. Occupational health in Africa started with employment of General Practitioners on either part time or full time basis in few organisations such as United African Company and John Holt and in 1969. The government of Nigeria, a developing country, requested and obtained a technical assistance from International Labour Organisation on the development of occupational health.

3.5 Historical Development of Industrial Health in Nigeria

The predominance of agriculture as the major occupation in Nigeria before colonial era encouraged mass production of cocoa, palm-oil, ground-nuts, millet and hardwoods. During this time, mechanized farming was not practiced hence the use of traditional tools such as cutlasses and hoes. The emergence of industrialization in Nigeria can be traced to the establishment of subsidiaries of factories which parents' industries were located in developed countries of the world. Industrialization in Nigeria brought with it exposure of people to hazards as a result of the use of machine and exposure to harmful chemicals. According to Omokhodion (2019) occupational diseases reported in the literature suggests that conjunctivitis, chronic bronchitis,

dermatitis, musculoskeletal disorders and injuries are common workplace health problems.

In 1951 Ministry of Labour was created followed by secondment of chief factory inspector to Nigeria from the British Ministry of Labour in 1952 and in 1955 factories ordinance was modelled after the British Factories Act of 1937 and 1949. The first major legislation in occupational health was the Factories Ordinance in 1955. Provision was made for minimum standards for safety and health. Also, safe entry and exists, safety devices, safe drinking water, washing facilities as well as first aids were well defined (Patterson, 2010).

A substantial revision of the colonial legislation (Factories Act 1958 and the 1987 decree) changed the definition of a factory from an enterprise with ten or more workers to premise with one or more workers thereby providing oversight for the numerous small-scale enterprises that engage the majority of the workforce in Nigeria. The current legislation is the Factories Act 1990 which in essence is the same as the 1987 legislation. Enforcement of legislation was carried out by the Factory Inspectorate of the Ministry of Labour. This ministry provided a National Policy on Safety and Health in 2006 when details the responsibilities of employers, workers, manufacturers and government agencies in the maintenances of the health and safety of workers (Omokhodion, 2009).

3.6 Future Trends of Industrial Health

A major declared aim of industrial health is the protection of social, mental and physical wellbeing of workers in all occupations from working conditions that have potentials to affect a worker's health and safety. This is in the realization of the fact that the wellbeing of the worker is a precursor to the production of quality goods and services for a satisfaction and economic development. Industrial health will continue to be relevant as long as human being has roles to play in industrial establishment. At least, workers will operate machine for it to produce.
The relevance of industrial health has brought with it the following:

- Technology has come to stay. Products of technology such as machinery will continue to be used massively in industries. Increased rate of human error and faults of machine will always lead to accident occurrences in industrial establishment.

- All machines have their health hazards. The associated hazards will always lead to ill-health or injuries. The possibility of the increase in the health hazards is high as a result of increase in the use of machines in industries.

- In the contemporary society such occurrence as increase in cost of living, insecurity, stained relationship, family instability, failed promises, religious intolerance and poor supply of social amenities will continue to increase mental health problems among the people. Workers are part of society that are also affected by the phenomenon. The challenge of this problem can be overwhelming on industrial health.

- Increase in the number of industries in the country makes for healthy economy. However, the waste products generated can constitute nuisance to the environment. Effective disposal of waste product has continued to be problem hence pollution of the environment.

Nigeria is a developing country aspiring to join the comity of developed nations of the world. Industrialization is an important index of national development. The government, managers of industries and other stakeholders should refocus industrial health in terms of resource allocation.

In the world over currently, the economy is knowledge driven. Therefore, more research efforts should be directed at improving industrial health in various industrial establishments.

National Health Insurance Scheme should be encouraged in industrial establishments. This is to provide alternative means of funding medical health services.

The future of industrial health has to be bright because health is wealth. Health makes for production of quality goods and services needed for healthy national economy.

SELF-ASSESSMENT EXERCISE

Narrate the history of industrial health in United Kingdom and United States of America.

4.0 CONCLUSION

The unit narrated the history of industrial health in the ancient times, in United Kingdom, United States of America as well in Nigeria. The future trend of industrial health was also examined. It was concluded that the future of industrial health should be made to be bright by government and managers of industries by allocating adequate resource to industrial health.

5.0 SUMMARY

In this unit you have learnt:

i. History of industrial health in the ancient times in the world over.
ii. History of industrial health in United Kingdom as well as United States of America.
iii. History of industrial health in Nigeria as well as the future trends of industrial health in the country.

6.0 TUTOR-MARKED ASSIGNMENT (TMA)

1. Narrate the history of industrial health in United Kingdom and United States of America.
2. What are the roles of stakeholders in making the future of industrial health bright?

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MODULE 3 INDUSTRIAL HEALTH HAZARDS

Unit 1 Concepts and Types of Industrial Health Hazards
Unit 2 Industrial Health Hazards Identification: Importance and Process
Unit 3 Industrial Toxicology

UNIT 1 CONCEPTS AND TYPES OF INDUSTRIAL HEALTH HAZARDS

CONTENTS

1.0 INTRODUCTION

In industrial establishment workers interact with co-workers as well as the work environment including machines. Hazards emanate from these interactions. Hazard left unidentified can negate the promotion of physical, mental and social well-being of workers.

The unit exposes the students to the meaning and concepts of hazard and industrial hazards as well as types of industrial health hazard.

2.0 OBJECTIVES

By the end of this unit, you should be able to:

- Define hazard and industrial health hazard
- Identify and explain types of industrial health hazards

3.0 MAIN CONTENT

3.1 Hazard and Industrial Health Hazards

Hazards are objects, events or entity that constitute danger to the health of a person. The probability of an individual been at risk of hazard depend largely on the type of interaction that is taking place between the person and objects. Ontario Agency for Health Protection and Promotion (2019) defined health hazard as chemical, physical or biological factors in our environment that can have negative impact on our short- or long-term interaction. It was further explained that exposure can occur through touch, inhalation and ingestion.

Industrial health hazard can be described as events or objects in an industrial premise that are capable of causing harm to workers in the process of carrying out his/her normal duties. In industries, machines are good servants in that they are made use of in the production process, however, mishandling machine and operating faulty machine can put workers at the risk of being harmed.

It is therefore important that workers have a good understanding of the risk of hazards located in his/her industrial establishment so as to initiate action to avoid or mitigate the risk.

3.2.1 Types of Industrial Health Hazard

Industrial establishment objects or events that constitute hazard are many. WHO (2001) and Park (2019) grouped hazards resulting from work in industrial establishment to include:

(i) Physical Hazard
(ii) Biological Hazard
(iii) Chemical Hazard
(iv) Mechanical Hazard
(v) Ergonomic Hazard
(vi) Psycho-Social Hazard

A. Physical Hazard

Physical hazard is an object, event or agent that can wreak havoc to health of workers when a close contact has taken place. Physical hazard which has been found to affect health include heat, cold, height, illumination, abnormal pressure, noise, vibration, ultraviolet radiation and ionizing radiation. The health of workers in industrial establishment is often negatively affected by the agents of physical hazard.

Explanation on physical health hazard and their health effect are given thus:

i) **Heat in industries:** Heat is largely generated as a result of the use of energy. In fact, in most cases heat is used to generate power. Workers who are mostly affected are those working in bakeries, glass and steel industries, soap factory, breweries, and blacksmith. Effects of exposure to heat on health include heat stroke, heat cramp, heat rash and heat exhaustion.

- **Heat stroke**: It is a severe heat illness resulting in body temperature higher than 40^{o}C accompanied by dehydration. Heat stroke is a form of hyperthermia in which the body temperature rises suddenly. It can be caused by prolonged work involving physical exertion in higher temperature condition. The sign and symptoms are absence of sweats, rapid pulse rates, headache, convulsion, dizziness and nausea.

Workers experiencing heat stroke should do the following to get relieved of the illness.

(i) Loosen or remove tight clothing
(ii) The individual should lie down to rest
(iii) He/she should be allowed to drink cool water only if the person is conscious
(iv) Monitor the temperature to ensure that it returns to normal

- **Heat Cramp**: It is an experience of painful involuntary muscle jerk which occurs as a result of loss of water and nutrient during or after heavy exertion accompanied by profuse sweating in high heat condition. Symptoms of heat cramp include moist skin, pale skin, light headedness. Heat cramps affect mostly legs, anus, abdomen or back.

In order to get relieved of heat cramp the following are suggested.

- Lie down to rest in a cool place.
- Have cool drink that has electrolytes and salt.
- In order to prevent muscle cramp, have adequate replacement of fluid in the body when you work in a hot place.
- **Heat rash:** It is a condition characterized by blocked sweet ducts and trapped sweat beneath the skin. It is a common occurrence during hot weather condition. The individual having heat rash experiences itching body and red bumps. The parts of the body usually affected by having heat rash are neck, under breast, under scrotum and face.

Treatment include moving the affected person to cool areas. Removal of the clothing of the individual to allow for exposure to fresh air.

- **Heat exhaustion:** It is an ill-health condition that follows over exposure to high temperature accompany by dehydration. Symptoms of heat exhaustion include, rapid heartbeat, headache, pale skin, fatigue and convulsion.

The individual affected by heat exhaustion can be relieved of the condition by doing the following:

- Loosen clothing
- Lie down to rest in cool area
- Apply cool towel on the body
- Drink cool water

ii. Prolonged exposure to cold

The body's stored energy can eventually be used up when a person is exposed to extreme cold over long time. When the body temperature becomes too low it affects the brain adversely making clear thinking to be difficult. The hazard associated with excessive exposure to cold in the process of work are:

i. Chilblains
ii. Immersion foot
iii. Frostbite
iv. Hypothermia

- **Chilblains**

Chilblain also known as pernio is an ill-health condition in which there is painful inflammation of small blood vessels of the skin. It occurs in response to prolonged exposure to cold. Chilblain can cause itching, red patches, swelling and blistering to feet and hand.

The signs and symptoms:

(i) burning and itching sensation that occur at the extremities such as feet, hand, nose and ear
(ii) change in skin colour from red to dark blue.
Symptoms of chilblain can be eased by rewarming skin gently, keep skin dry and warm and application of lotion to reduce the itching.

- **Immersion foot**

Immersion foot also known as trench foot is an injury of the feet as a result of prolonged exposure to cold. It can result from continued exposure to temperature between 0^{o}C to15^{o}C. Signs and symptoms are itching, pain, swelling, numbness, heavy feeling. Treatment of immersion foot are:

(i) Thorough cleaning and drying of feet
(ii) Ensure that clean dry socks are worn
(iii) Apply warm water to the affected part the body

- **Frostbite:**

Frostbite is disease condition caused by skin injury which occurred when exposed to extremely low temperature causing the freezing of skin. The disease condition results when skin directly contact very cold surface. Symptoms of Frostbite include numbness, discoloured skin (red, white, gray or yellow), pain around the affected areas, blisters on the skin.
According to Health line (2017) immediate first aid for frostbite are:

i. Seek shelter from the cold
ii. Warm hands by tucking them under arms
iii. Go indoors and remove wet clothing and jewelry
iv. Place hands and feet in warm water and cover the rest of the body with a blanket
v. Avoid sources of heat such as lamps, fire or heating pads. These can burn frostbite skin
vi. Drink warm water if dehydrated
vii. Consult your doctor as soon as possible

- **Hypothermia**

Hypothermia is a condition in which there is significant drop in body temperature due to prolonged exposure to cold. The normal temperature is 37oC but in a situation where body temperature falls below 35oC hypothermia has occurred. Drop in body temperature can lead to inability of the heart, nervous system and other organs to function normally. Hypothermia should be treated early to prevent heart failure. Exposure to cold weather as well as immersion in water can cause hypothermia. Shivering is the first sign that a person having hypothermia shows.

Other signs and symptoms are:

(i) weak pulse,
(ii) memory loss,
(iii) slurred speech,
(iv) poor co-ordination,
(v) poor breathing,
(vi) drowsiness and poor muscular co-ordination,

Workers mostly affected by hypothermia are night guards, those who are dealing in frozen foods and ice cream.

Prevention of Hypothermia: Mayo clinic (2020) list the following as preventive measures against hypothermia:

(i) **Cover** - Wear a hat or other protective covering to prevent body heat from escaping from your head, face and head, face and neck. Cover your hands with mitten instead of gloves.
(ii) **Overexertion:** Avoid activities that would cause you to sweat a lot. The combination of wet clothing and cold weather can cause you to lose body heat more quickly.
(iii) **Layers:** Wear loose fitting layers light weight clothing. Outer clothing made of tightly woven, water-repellent material is best for wind protection. Wood, silk or polypropylene inner layers hold body heat better than cotton does.
(iv) **Dry:** Stay as dry as possible**.** Get out of wet clothing as soon as possible. Be especially careful to keep your hands and feet dry, as it is easy for snow to get into mitten and boots.

iii. Height

There are certain workers whose nature of work involve climbing height using cranes, scaffolds or ladders. The categories of the workers are construction workers working on roofs or building, Power Holding Company of Nigeria (PHCN) formerly known as National Electric Power Authority (NEPA) workers working on electric poles. These workers are at the risk of falling off from height and consequently sustaining such injuries as fracture, cuts and bruise and even death ultimately (Oladipo, 2003).

iv. **Faulty Illumination**

Illumination is referred to a lighting. Poor illumination can cause a worker to misjudge the position, shape or speed of an object. Lightning when it is too much or too little can cause eyes strain, headache and eye discomfort. Defective illumination can lead to low productivity given the fact that the quality of work will be affected especially when precision is required. Poor lighting can make reading of print material to be difficult.

In order to correct poor light distribution in an office Canadian Centre for Occupational Health and Safety (2020) suggested the following.

- Supplementing or replacing light fixture with ones that distribute some lights upwards'
- Painting ceiling and walls in light colours that reflects light.
- Cleaning ceiling, walls and fixtures.

v. Abnormal Air Pressure

Exposure to abnormal pressure under or inside water compresses or distends close cavities inside the body resulting in squeeze, nitrogen narcosis, oxygen intoxication, decompression, sickness, reverse block, lung edema and arterial gas embolism (Itorie, 2014).

Set of workers more likely to encounter pressure below atmospheric air include pilots, astronauts, crew of high-performance aircrafts and sports athletes who perform in high altitude. The effect of abnormal air pressure for above the atmospheric pressure include pain in the ears or rupture of the eardrums. This high pressure also forces air to dissolve in the blood thereby causing nitrogen diseases if the individual concerned is suddenly lifted to the surface of water while effect of exposure to pressure below atmospheric air can be felt in the blockage of ears and difficulty in breathing (Oladipo, 2002).

vi. Industrial Noise

Sound is denoted as vibration that move rapidly through such medium as liquid, solid and gases and can be heard by functional ears of a being. Noise is any sound that is potentially harmful to health or safety of a person. All sounds (in the workplace), whether wanted or unwanted can be harmful. Noise is classified as either occupational noise – i.e. noise in the workplace, or as environmental noise which includes noise in all other settings, whether at the community, residential, or domestic level (e.g. traffic, playgrounds, sport and music) safety [Concha-Barientas Campheillendrum & Steenland, 2004 in HaSPA 2012]

Industrial noise can be injurious to a worker hearing thereby causing hearing impairment when is loud enough, close enough and sustained long enough to cause physical harm to the hair cells in the auditory system. Generally high noise levels are hazardous to hearing as they can produce other adverse effects.

Industrial noise gained prominence through the works of such personalities as Pliny the Elder's Naturalis Historiae (Natural History) which referred to the noise of the felling water in the Nile cataracts and

its ill effects on the hearing of the local inhabitants. Also, Bernando Ramazzim described the hearing impairment of coppersmiths in De Morbis Artificum Diatriba (Diseases of Workers). According to Safety Institute of Australia (2002) works by Thomas Barr (1886) on hearing loss in Scotish boilermakers, and Gottstein and Kayer (1881) on German personnel in railway works, were landmark studies in the development of modern day understanding of occupation noise-induced hearing loss, also Greorge von Bekesy (1899-1972) discovered the travelling wave by which sound is analysed and communicated in the cochlea.

Decibel (dB) is the unit for expressing the ratio between two physical quantities, usually amounts of acoustic in electric power or measuring the relative loudness of sounds. According to Oladipo (2013) an audible comfortable range is between 20 and 60 decibels. Some discomforts may occur above 60 decibels, while harmful effects occur above 90 decibels, levels of noise below 75 decibels have been noted not to be dangerous while levels above 80 to 85 decibels are rather unsafe. Suter (2019) found that many workers throughout the world experience some very hazardous exposure, well above 85 or 90 dBA. She further reported that the United Stated Department of Labour estimated that 19.3% of the workers in manufacturing and utilities are exposed to daily average noise levels of 90dBA and above 34.4% are exposed to levels above 80dBA; these estimates should be fairly typical of the percentage of workers exposed to hazardous levels of noise in other nations. Also, she opined that the levels are likely to be somewhat higher in less developed nations, where engineering controls also not used as widely and somewhat lower in nations with stronger noise control programmes, such as the Scandinavian countries and Germany.

Noise is a common health hazard and is present to some extent in almost all work places; it is the most common health hazards in industries such as entertainment, manufacturing agriculture, ship-building, textiles, mining and quarrying, food and drink, woodworking, metal working and construction. Some common sources of noise are loud music, the use of heavy machines, workplace transport, electrical tools such as circular saws and cutter heads, production lines, pneumatic tools such as drills, grinders and riveting guns, electrical motors and generators, engineering processes such as metal fabrication and plant rooms where ventilation equipment has to run continuously (Iosh, 2018). According to Iosh, (2018) excessive noise is a global occupational health hazard with considerable social and physiological impacts; exposure to loud noise from all source's accounts for about 20 percent of adult-onset hearing loss, while 16 percent of the disabling hearing loss in adults is attributed to occupational noise. Noise-induced hearing loss is considered the 15th most serious health problem in the world.

Effects of Industrial Noise on Human Health

Exposure to industrial noise can have detrimental effects on workers' health. It should be noted that health effect experienced by workers can be as a result of exposure to very loud noise or high level of noise over a prolonged period of times. However, effect of noise on hearing depend largely on duration of exposure, distance from the source, sound pressure, individual susceptibility and frequency range.

The major health effects are briefed as follows:

(i) **Tinnitus**: It is also known as ringing in the ears. It is an indication of both temporary and permanent hearing loss most especially from noise. Exposure to high intensity noise often leads to tinnitus. Tinnitus leads to disturbed sleep and impaired speech.

(ii) **Physiological Effects**: Noise can have effect on the cardiovascular system, resulting in an increase in blood pressure and the release of catecholamines in the blood; an increased level of catecholamines in the blood is associated with stress.

(iii) **Hearing Loss**: Persistent exposure to noise in an industrial setting damages the delicate hearing mechanism of the inner ear leading to permanent hearing loss.

(iv) **Effects on task performance**: Excessive noise has been known to interfere with concentration and efficiency of workers. Suter (2019) submitted that intermittent noise tends to be more disruptive than continuous noise, particularly when the periods of noise are quite unpredictable and controllable.

(v) **Irritation and annoyance**: Persistent noise can trigger irritation and annoyance in an industrial worker. Furthermore, irritation and annoyance can constitute distraction which can lead to human error. Essentially worker who is persistently exposed to noise stand the risk of inaccurate judgment as well as poor decision making.

Noise Measurement and Exposure Evaluation in Industrial Setting

The starting point for the prevention of damaging effects of industrial noise on worker is to determine the level of exposure. It is important to take into consideration the selection of appropriate instrumentation, measuring methods and active procedure for evaluating exposure of workers to industrial noise. Denisou and Suvorou (2019) identified three types of noise exposures to include continuous, intermittent and impulse noise; this is in order to identify noise environments with differing frequency spectra, as well as to consider the variety of working situations, such as drop-forge hammering stops, rooms housing air compressors, ultrasonic wielding processes. They further identified the

main purposes of noise measurement in an industrial establishment to include: (1) identify overexposed workers and quantify of their exposures; (2) assess the need both for engineering noise control and the other types of control that are indicated; other uses of noise measurement are to evaluate the effectiveness of particular noise control and to determine the background levels in audiometric rooms.

The identified instruments for noise measurement include sound level meters, noise dosimeters and auxiliary equipment. The basic instrument is the sound level meter which is an electronic instrument consisting of a microphone, amplifier, various filters, a squaring device, an exponential average and a read-out calibrated in decibels [dB]. Sound level meters are categorized by their precision, ranging from the most precise [type O] to the least [type O]. Type O is usually used in laboratory, type 1 is used for other precision sound level measurement, type 2 is the general-purpose meter and type 3, the survey meter, is not recommended for industrial use. For measuring non-steady noise exposures, such as those that occur in intermittent or impulse noise environments, an integrating sound level meter is most convenient to use. These meters can simultaneously measure the equivalent, peak and maximum sound levels and calculate log, and store several values automatically. The noise dose meter or "dosimeter" is a form of integrating sound level meter that can be worn in the short pocket or attached to the worker's clothing. Data from the noise dosimeter may be computerized and printed out. Auxiliary equipment refers to any electronic device that is capable of functioning independently without any direct communication with the main processing mode. It is important to make sure that noise measuring instruments are always properly calibrated. This means checking the instrument's calibration acoustically before and after each day's use, as well as making electronic assessments at appropriate intervals.

Noise Measurement Methods

In order to take accurate measurement of noise in an industrial establishment appropriate method must be used. According to Denisou and Suvorou (2019), the noise measurement methods to be used depend on the measurement objectives, namely, to assess the following:

- the risk of hearing impairment
- the need for and appropriate types of engineering controls
- the noise load for compatibility with the type of job to be performed.
- the background level of communication and safety.

The International Standard ISO gives three types of method for noise measurement:

(1) the survey method (2) the engineering method and (3) the precision method.

The survey Method. This method requires the least amount of time and equipment. Noise levels of a working zone are measured with a sound level meter using a limited number of measuring points. Although, there is no detected analysis of the acoustic environment, time factors should be noted, such as whether the noise is constant or intermittent and how long the workers are exposed. The A-weighing network is usually used in the survey method, but when there is a predominant low-frequency component, the C-weighing methods or the linear response may be appropriate.

The engineering method. With this method a weighted sound level measurement or those using other weighting networks are supplemented with measurements using full octave or 1/3 octave-band filters. The number of measuring points and the frequency ranges are selected according to the measurement objectives. Temporal factors should again be recorded. This method is useful for assessing interference with speech communication by calculating speech interference level [SILS], as well as for engineering noise abatement programmes and for estimating the auditory and non-auditory effects of noise.

The precision method. This method is required for complex situations where the most thorough description of the noise problem is needed. Overall measurements of sound level are supplemented with full octave or 1/3 octave band measurement and time histories are recorded for appropriate time intervals according to the duration and fluctuations of the noise for example, it may be necessary to measure peak sound levels of impulses using an instrument peak hold setting, or to measure levels of intrasound or ultrasound requiring special frequency measurement capacities, microphone directing, and so forth. Those who use the precision method should make sure that the instruments dynamic range is sufficiently great to prevent overshoot when measuring impulses and that the frequency response should be broad enough for intrasound or ultrasound is to be measured. The instrument should be capable of making measurements of frequencies as low as 2Hz for intrasound and up to at least 16Hz for ultrasound, with microphone that are sufficiently small.

Experts identified the two basic approaches to measuring noise in the workplace as follows:

i. Type of worker representative may be measured. The noise dosimeter is the preferable instrument for this purpose.

ii. Noise levels may be measured in various areas, creating a noise map for the determination of risk areas. In this case, a sound level meter would be used to take readiness at regular points in a coordinated network.

Evaluation of Workers' Exposure to Noise in an Industrial Setting

The task of a carrying out the accurate assessment of workers' exposure to noise in an industry can be effectively achieved only if the standard suggested by experts such as International Standard ISO 1999 as reviewed by Denisou and Suvorou (2019) is used:

- Noise exposure should be measured in the vicinity of the workers ear and, in assessing the relative hazard of workers' exposures, subtractions should not be made for the attenuation provided by hearing protection devices. The reason for this caveat is that there is considerable evidence that the attenuation provided by hearing protectors as they are worn on the job is often less than half the attenuation estimated by the manufacturer. The reason for this is that the manufacturers data are obtained under laboratory conditions and these devices are not usually fitted and worn so effectively in the field. At the moment, there is no international standard for estimating the attenuation of hearing protectors as they are worn in the field but a good rule of thumb would be to divide the laboratory values in half.
- In some circumstances, especially those involving difficult tasks or jobs requiring concentration, it may be important to minimize the stress of fatigue related to noise exposure by adopting noise control measures. This may be true even for moderate noise levels [below 85 dBA], when there is little risk of hearing impairment, but the noise is annoying or fatiguing. In such cases it may be useful to perform loudness assessment using ISO 532 [1975].

Method for Calculating Loudness Level.

- Interference with speech communication may be estimated according to ISO 2204 [1979] using the "articulation index" or more simply by measuring the sound levels in the octave bands centred at 500, 1,000 and 2,000Hz, resulting in the 'speech interference level".

However, the selection of noise exposure standard should depend on the goal to be attained, such as the prevention of hearing loss or the prevention of stress and fatigue. Maximum permissible exposures in terms of daily average, noise levels vary among nations from 80 to 85, to

90dBA, with trading parameters [exchange rates] of 3, 4, or 5 dBA. In some countries, such as Russia, permissible noise level is set, anywhere from 50 to 80 dBA according to the type of job performed and taking into account the mental and physical work load. For example, the allowable levels for computer work or the performance of demanding clerical work are 60 to 60 dBA.

Control of Industrial Noise Hazards

Noise is hazard that continue to affect the health and safety of workers in industrial settings. The control of noise hazard is a pragmatic step towards promoting the wellbeing of worker. In industry there are variations in exposure to noise. Therefore, it is important that for effective control of industrial noise priority sources must be determined through identification and thorough analysis.

The control of identified source of noise that are likely to produce excessive noise requires the determination of the duration of use of each machine or item of equipment during a typical shift and the time the operator spend using them or working near them. For instance, a machine equipment item with a high noise level, but with short usage per shift may well have a lower priority for noise reduction than machine or equipment item with low noise level but long usage per shift. For example, a milling machine operated for six hours per day at 88dB(A) at the operator's ear, needs more urgent noise reduction than an auger operating for 15 minutes per day at 94 dB(a). It shows that at 94dB(a) it only takes one hour to reach the red area. Therefore, the auger needs more urgent treatment than the milling machine (HaSPA, 2012).

The submission of HaSPA (2012) after a review of codes of practice such as those for plant, risk assessment, construction and tunneling are briefed below:

1. **Elimination or Minimisation Through Safe Design**: Workplace noise that exceeds the exposure standard must, so far as reasonably practicable, be reduced to non-hazardous exposure levels. The best way to do this is by eliminating the source of noise emission. One way of doing this is by no longer carrying out the work that created the noise. When this is not practicable, substitution of the activity or process by changing the noise components of the activity or process for a quieter one should be considered, e.g., instead of hammering a piece of metal to blend it the metal could be heated and then bend with pliers or a press.
2. **Engineering Control**: Engineering noise control addresses control at the source by modifying the noise source itself or through enclosures (e.g., made from a solid material and lined

internally with a sound-absorbent lining) modifications and/or additions (e.g. silencers or muffliers to existing noise sources), placing barriers in the noise path or by enclosing the receiver end (e.g. a control room). Generally, engineering noise control is the most effective way of controlling noise, but may sometimes be most prohibitive.

Some basic principles of engineering noise control are:

- Mounting vibrating sources within machines on isolators or dampeners.
- Replacement of metal components with quieter materials such as plastic nylon or compound components.
- Installing local enclosures around particular noisy machine components.
- Incorporation of sound absorbent materials.
- Provision of air and gas exhausts with silencers.
- Change to a quieter type of fan, fan blade, pitch or number of blades, or fitting sound attenuators in ventilation ducts.

3. **Administrative Control**: Administrative noise control measures aim to reduce the amount of noise to which a worker is exposed via organizational methods, for example, delineating hearing protective areas, noise mapping to identify safe/unsafe noise areas, rescheduling workers' duties to limit exposure times, optimizing maintenance, replacing old plant and equipment with new quieter plant and equipment through "Buying Quiet" Programme
4. **Hearing Protection**: Hearing protector should be worn where hazardous noise levels exist in the workplace that cannot be reduced by higher-order controls or until such times that the noise levels have been reduced to non-hazardous levels through elimination, substitution or engineering noise-control measures (Safe Work Australia, 2010a). There are three basic types of protectors available: disposable or individually moulded earplugs, ear canal caps and passive or active earmuffs. Passive earmuffs are the conventional type while electronically active level-dependent earmuffs allow noise up to 82dB to enter the ear after which an electronic system shuts the reception down and they act like passive earmuffs. Noise-cancelling earmuffs reduce (mainly) low-frequency noise by monitoring the noise environment outside the earmuff and introducing an anti-sound of 180-degree phase difference to the original sound wave.

The principle of this is that a positive and a negative canal ease other out, hence the term "noise cancelling". In reality while not all noise is cancelled out, a significant noise reduction is obtained.

A common misconception is that hearing protectors control noise: hearing protectors do not control workplace noise as the noise in the workplace is still there but the wearing of a hearing protector reduces the in-ear noise level. Exposure is not reduced by the wearing of personal hearing protectors. A person wearing protectors in a sound field in a situation of protected exposure, not non-exposure (SA/NZS2005b). Thus, hearing protectors should be used only when other means of control are not reasonably practicable. When hearing protection is required, there should be a systematic approach that includes:

- Selection of hearing protection by a suitably qualified person.
- Training in fitting and wearing of the hearing protection for those required to use the wearing protection.
- Establishment of arrangements to fit the hearing protectors before entering the noisy work area.
- Establishment of arrangements for clearing, maintenance and secure storage.
- Marking of areas where hearing protection is required.
- Appropriate documentation.
- Monitoring of the effectiveness of the hearing protection use.
- Management and oversight by a suitably qualified person.

5. **An Occupational Noise Management Programme**. Where noise is likely to be in excess of the noise exposure standard, the workplace should implement a systematic noise management programme. A noise management programme contains the following key elements:

- Hazards identification
- Risk assessment
- Hearing conservation policy statement.
- Noise level exposure surveys
- Engineering and administrative noise-control measures
- Education and training.
- Personal hearing protection
- Audiometric testing
- Evaluation of effectiveness of the programme
- Record keeping system

6. Vibration as Industrial Health Hazard

Vibration occurs when there is mechanical oscillations of an object about an equilibrium. Vibration consists of oscillatory movements of particles (molecules) around their equilibrium in a solid body, liquid or gas, in the area of intrasound (i.e.,<20Hz and partially also in the audible sound frequency range (up to 1500Hz) (HaSPA, 2012).

The oscillation that causes vibration may be regular such as the motion of pendulum or random such as the movement of a tyre on a gravel road. Vibrations do occur in our daily life experiences. Such as washing machine shaking due to imbalance, and transportation. Vibration caused by engine on unenven road as well as vibration of building during earthquake are all examples of vibration.
Vibration enters the body from the part of the body or organ in contact with vibrating equipment Corncane (2008) in HaSPA 2012) describes two main types of vibration exposure – "whole body vibration – the body is shaken by a machine or vehicle" and "hand-arm vibration – where the vibration effect is localized on the hand and arm. When a worker operates handheld equipment such as a chain saw or jack hammer the vibration affect hand and arms. Such an exposure is called hand-arm vibration exposure; when a worker sits or stands on a vibrating floor or seat, the vibration exposure affects almost the entire body and is called whole-body vibration [CCOHS, 2020). Processes where vibration is deliberately introduced include concrete pours with vibrators to shake wet concrete into place, vibrating beds in rock quarrying to select particle size and cleaning baths for industrial products; industries with significant vibration exposure include forestry, mining, metal manufacturing, agriculture, furniture making, construction, cleaning and transportation (HaSPA, 2012).

The main health effect from hand-arm vibration is caused by the disruption of blood and oxygen supply to the fingers from prolonged vibration exposure resulting as damage to blood vessels and nerves systems that initially are reversible, but with continued exposure eventually become irreversible. CCOHS (2008) identified the main effect from whole-body vibration has damage to the lower spine area as well as damage to internal organs [HaSPA, 2012]

Control of Vibration Hazards

HaSPA (2012) identified control for hand-arm vibration as well as whole-body vibration.

(a) The recommended controls for hand-arm vibration include
    i. Elimination/design
    ii. Buy quite principles are included in purchasing policies
    iii. Hazard identification processes and workplace inspections include subjective and/or objective assessment of noise-level.
    i. When indicated, risk assessment processes include noise surveys conducted by suitably qualified person.

ii. Maintenance processes address noise and vibration issues and include monitoring of condition of plant and equipment for noise and vibration.
iii. Manager, supervisors and workers receive appropriate information and training on noise and vibration hazards and where required the fitting, wearing and maintenance of hearing protectors.
iv. Areas where hearing protection are required are identified and signposted.
v. Where required appropriate processes are in place for selection and supply of heating protectors.
vi. The need for an audiometric testing is identified and appropriate processes are in place for conduct and documentation of hearing testing.
vii. The effectiveness of the noise management programmes is monitored through audit, noise survey and other appropriate measures.

(b) Recommended controls for whole-body vibrations include

(i) **Elimination/Design** - Treating the vibration source, the transmission path or the receiver, or a combination of the three, to eliminate or minimize exposure of workers. Ensuring drivers of vehicles can regularly change posture without compromising control of the vehicle.

(ii) **Engineering** - Insulating seats and head rests in cases where vibration is transmitted through the seat or headrest, through incorporation of spring and dampers.

(iii) **Administrative Controls** - Ensuring that plant and equipment are well maintained to avoid resonance and excessive vibration.

- Maintaining roads or other surface areas in good condition (i.e. fill in potholes as soon as they occur)
- Limiting the speed at which vehicles travel depending on terrain conditions.
- Limiting the time spent by workers on vibrating surfaces.
- Incorporating mini breaks on a regular basis.
- Incorporating seat maintenance and replacement programmes.

7. **Ultraviolet Radiation**

Radiation is the discharge of energy from any source. Ultraviolet radiation is any form of electronic magnetic radiation that originate from either natural or artificial source. Natural source of ultra violet radiation is sun while artificial source of ultraviolet radiation comprises of tanning beds, mercury vapor lighting, some types of lasers and some halogen and fluorescent lights. Ultraviolet radiation is grouped into three, based on the measure of their wave length. Ultraviolet A (UV, A) ultraviolet B (U, VD)

and ultraviolet C (UVC). UVA rays have the longest wave length and the next is UVB followed by UVC.

Ultraviolet radiation is that portion of the electromagnetic spectrum extending from the violet, or short-wavelength, and of the visible light range to the x-ray region. (Encyclopedia Britannica, 2020). Electromagnetic radiation also known as Electromagnetic energy is made up of minute packets of energy or 'particles' called photons, which travel in a wave-like pattern and move at the speed of light. (IDA, 2020). Apart from ultraviolet radiation, radio waves that transmit sound from radio stations tower to stereo, or between cell phones; microwaves, like those that heat food in a microwave oven; visible light that is emitted from the light in homes; and X-rays like those used in hospitals X-rays machines to capture images of bones, inside body are all forms of electromagnetic energy. (FDA, 2020).

Ultraviolet radiation has a low power of penetration; hence, its direct effects include: reddening of the skin (sunburn), pigmentation development (suntan), aging and carcinogenic changes. Ultraviolet sunburns can be mild, causing only redness and tenderness or they can be so severe as to produce blisters, swellings seepage of fluid and sloughing of the outer skin. The blood capillaries (minute vessels) in the skin dilate with aggregations of red and white blood cells to produce the red coloration. Tanning is a natural body defense relying on melanin to help protect the skin from further injury. Melanin is a chemical pigment in the skin that absorbs ultraviolet radiation and limits its penetration into tissues. A suntan occurs when melanin pigments in cells in the deeper tissue portion of the skin are activated by ultraviolet radiation, and the cells migrate to the surface of the skin. When these cells die, the pigmentation disappears. Persons of light complexion have less melanin pigment and so experience the harmful effects of ultraviolet radiation to a greater degree. Application of sunscreen to the skin can help to block absorption of ultraviolet radiation (Encyclopedia Britannica, 2020).

Beneficial effects of UV radiation include the production of Vitamin D, a vitamin essential to human health, vitamin D helps the body absorbs calcium and phosphorous from food and assists bone development. The World Health Organisation (WHO) recommends 5 to 15 minutes of sun exposure 2 to 3 times a week (CDC, 2020).

Specific Health Hazards Associated with Ultraviolet Radiation in Industry

The adverse effect of ultraviolet radiation is restricted to the skin and eye. The effect can manifest over both the short and long term. The effects of

Ultraviolet (UV) radiation on the skin and eyes as identified by WHO (2003) are briefed below.

Effect of UV radiation on the skin – Short-term exposure to UV radiation causes reddening of the skin, sunburn and swelling, which may be very severe. In some people this sunburn is followed by increased production of melanin, and is recognized as a suntan. Tanning is a sign that damage skin is attempting to protect itself from further harm. A suntan offers only minimal protection against further exposure. The most serious long-term effect of UV radiation particularly for white skinned population, is the induction of the skin cancer.
The non-melanoma skin cancer [NMSC] are basal cell carcinomas and squamous cell carcinomas. They are relatively common in white people, although they are rarely fatal. They occur most frequently on sun-exposed areas of the body such as the face and hands and show an increasing incidence with increasing age. Both acute burning episodes of sun exposure and chronic occupational and recreational exposure may contribute to the risk of malignant melanoma. Chronic exposure to solar radiation also causes photoageing of the skin and actinic keratosis. Photoageing is characterized by a leathery, wrinkled appearance and loss of skin elasticity while actinic keratosis is a known precursor to squamous cell carcinomas.

Effects of Ultraviolet Radiation on the eyes. Responses of the human eye to acute over exposure of UV radiation include photokeratitis and photo conjunctivitis (inflammation of the cornea and the conjuctivia, respectively), more commonly known as snow blindness or welder's flash. Symptoms range from mild irritation to sever pain and possibly irreversible damage. There is evidence that chronic exposure to intense levels of solar radiation is a contributory factor in the development of age-related muscular degeneration of the retina and cortical cataracts both a cause of blindness.

Management of Ultraviolet Health Risk in the Workplace

World Health Organisation (2003) suggest the following measures that can be put in place to control risks in the workplace.

(i) **Engineering controls**: Provision of shade cover or canopies can protect worker against the risk. In the case of non-solar sources of UV radiation, suitable engineering control measures would include opaque barriers, UV radiation blocking filters and door interlocking power supplies.
(ii) **Administrative Controls**. In order to protect the outdoor workers. There should be a rescheduling outdoor work programmes where possible to be performed outside the peak UV radiation period (2

hours either side of solar noon), moving where possible the jobs indoors to shady areas or rotating workers between indoors and outdoors tasks to lessen each employees total UV exposure. In the context of non-solar sources of UV radiation, administrative controls would include warning signs, keeping staff at a safe distance and limiting the time during which UV radiation sources are switched on. Training of supervisors and employees should be undertaken for workers exposed to solar and non-solar sources of radiation.

(iii) **Personal Protective Equipment (PPE)**. Outdoor workers should be provided with protective clothing that is loose fitting, made of close weave fabric and provides protection to the neck and preferably to the lower arms and legs. Hats should shade the face, neck and ears and have a wide brim (8-10cm). If hard hats have to be worn, they should have attached neck flaps. Sunscreen should be a minimum SPF 15, and be broad-spectrum, that is block UVA and UVB, and be applied regularly and liberally to exposed skin. Sunglasses should be close fitting; of a wrap-round design and block at least 99% UV radiation. In the context of non-solar sources of UV radiation, arc welders in particular need to be provided with purpose-specific protective equipment.

(iv) Training should be offered to all employees exposed to medium to very high levels of UV radiation at work so that they can understand the risk and what is expected of them during exposure at the workplace.

Common Ultraviolet Sources in the Workplace

Source	**Potential for Overexposure**	**Hazard Description**	**For Safety Advice Refer to:**
The Sun	Very High	UV from the sun is highest in summer, and 2 hours either side of solar noon. Clouds may do little to reduce UV levels.	Engineering & Administrative Controls, PPE and Training
Electric Welding Arcs	Very High	Welding arcs can exceed the UV radiation guidelines in seconds within a few meters of the arc. Worker's bystanders and passers-by can be overexposed to UV from the arcs if engineering controls are inadequate.	Engineering & Administrative Controls, PPE and Training
Tanning Lamps	High	These emit mostly UV-A radiation. Tanning lamps generally must exceed occupational guidelines in order to cause tanning.	PPE and Training
Germicidal Lamps	High	UVB and UVC emitting lamps used to sterilize work areas in hospitals and laboratories.	Engineering Controls, PPE and Training
UV Lasers	High	Source of intense UV radiation at a single wavelength, with no visible light.	Engineering, Administrative Controls and Training
UV Curing Lamps	Medium	Lamps are usually inside cabinets, but substantial hazardous UV radiation	Engineering, Administrative

		emitted through openings can exceed the UV guidelines in seconds.	Controls and Training
Black Lights	Medium to Low	Low-power UV-A lamps used in non-destructive testing (NDT), insect control, and entertainment.	Engineering Controls, Personal Protection
Lighting	Low	Most lamps used for lighting are made to emit little or no UV radiation	No precautions needed under normal conditions.

Source: Ontario Ministry of Labour Canada in World Health Organisation 2003 http://www.who.int.uv/publication/en/occupations/on

8. **Ionizing Radiation**

Ionizing radiation is a type of energy revealed by atoms and travels in the form of electromagnetic wave. Atoms are the building blocks of all matter. The spontaneous disintegration of atoms is called radioactivity and the excess energy emitted is a form of ionizing radiation while unstable elements which disintegrate and emit ionizing radiation are called radionuclides' (WHO, 2016). The identified forms of ionizing radiation are alpha, beta and neutron particles, and gamma and X-rays. Exposure to radiation can come from natural or artificial sources. According to WHO (2016) natural radiation comes from many sources including more than 60 naturally-occurring radioactive materials found in soil, water and air. Radon, a naturally-occurring gas, emanates from rock and soil and is the main source of natural radiation and every day, people inhale and ingest radionuclides from air, food and water. Also, people are also exposed to natural radiation from cosmic rays, particularly at high altitude. Artificial exposure to radiation comes from human-made sources ranging from nuclear power generation to medical uses of radiation for diagnosis or treatment.

Exposure to ionizing radiation may occur internally or externally. Internal exposure to ionizing radiation occurs when a radionuclide is initiated, ingested or otherwise entered into the bloodstream (for example, by injection or through wounds) internal exposure stops when the radionuclide is eliminated from the body either spontaneously (such as through excreta) or as a result of a treatment. External exposure may occur when airborne radioactive material (such as dust, liquid or aerosols) is deposited on the skin or clothes. This type of radioactive materials can often be removed from the body simply by washing. Exposure to ionizing radiation can also result from irradiation from an external source such as medical radiation exposure from X-rays. External irradiation stops when the radiation source is shielded or when the person moves outside the radiation field. Also, people can be exposed to ionizing radiation under different circumstances, at home or in public

places (public exposures) at their workplaces (occupational exposures) or in a medical setting (as are patients, caregivers and volunteers).

Type of Ionize Radiation, penetrating power and how it delivers dose to the body

Type of Ionizing radiation	**How it travels and penetrates**	**How it delivers dose to the body**
Alpha particles (α)	Alpha particles cannot penetrate most other materials. A piece of paper, the dead outer layers of skin, or even a few inches of air are sufficient to stop alpha particles.	Radioactive material that emits alpha particles can be very harmful to living cells when alpha particles are inhaled, ingested, or absorbed into the blood stream (e.g., through a cut in or area of non-intact skin).
Beta particles (β)	Beta particles can travel up to several feet in the air. Beta particles can be stopped by some plastics, aluminum, or a block of wood. Beta particles should never be shielded with lead or other high atomic number shields, which could result in X-rays being released.	Some beta particles are capable of penetrating the skin and causing radiation damage, such as skin burns. Beta particles are most harmful to living cells when they are inhaled or ingested.
Gamma rays (γ) and X-rays (electromagnetic radiation)	Gamma rays and x-rays are very penetrating and can travel great distances. Lead or concrete is able to reduce the intensity of gamma rays and X-rays.	Gamma rays and X-rays can easily pass completely through the human body; however, a fraction of the energy can be absorbed by tissue and can damage living cells.
Neutron particles	Neutrons have an exceptional ability to penetrate materials. Hydrogen-containing materials (concrete or water) are best for shielding neutrons.	Neutrons can contribute significantly to radiation dose.

Source: Occupational Safety and Healthhttp://www.osha.gov.usa/ionizingradiation/index/htm

(ii) Biological Hazards

Biological hazard otherwise called biohazard is a health problem posing complicated challenges to industrial health. Biohazard has been described

as hazard that encompasses biological substances including medical waste or samples of body tissues or fluids from a biological source, which may contain micro-organisms, viruses or toxins that can adversely affect human health (HaSPA, 2012). A large number of people are exposed to biohazard. This is because biological materials that predispose people to the hazards are found in many workplaces even at homes. Specifically, such biological material like human bodily matters (excreta, breastmilk, saliva and blood) animal and animal products (birds, fish, mammals, meat, milk, skin, bones and eggs) wastes (rubbish and sewage) formed biohazard. Sadly, many people are not aware and even knowledgeable about the menace of biohazard hence safety precautions are neglected and the health consequences continue.

Workers can be exposed to biohazard through such agents as infectious organisms which are bacteria, virus, protozoa, Helminthes, and rickettsia. The organisms are capable of causing such diseases as whooping cough, brucellosis, Qfever, typhoid fever, cholera, hepatitis A and B, Acquired Immunodeficiency Syndrome, mumps, ascariasis and tick typhus.
The transmission is through direct means in which there is the physical contact between an infected person and another individual. Indirect means whereby the susceptible person contact the disease through touching surface or material exposure to food-borne and water-borne toxins, droplet/airborne contamination and encounter with disease carrying micro-organisms from an infected person to susceptible person.

Workplace exposure to Biohazards
People are exposed to biohazards in their different workplaces. The workplaces where workers are exposed to biohazards can be categorized into three: medical care, agriculture, waste management and personal service.

1. **Medical Care**
   Hospital remains a place where exposure to biohazard is high. Sections where workers can be exposed to biohazards are consulting room, laboratory, cleaning section and laundry section.

a. **Consulting Room**: During the process of consultation there is the possibility that the health professionals have direct contact with patient especially while examining an infected person. In this way doctors can be exposed to biohazard of great magnitude. In order to prevent exposure to biohazards in the consulting room, health care practitioners should wear glove as well as nose and mouth masks during consultation.

b. **Laboratories**: Laboratory workers who are concerned with carrying out medical test using specimen such as stool, urine, blood and pus can greatly be exposed to biohazards.

c. **Cleaning Section**: Hospital workers whose duties involve cleaning. During general cleaning they can have contact with discarded disposable materials such as contaminated needles and syringe, cotton wool, and bottles. They inhale contaminated dusts emanating from the floor while sweeping.

d. **Laundry Section**: Workers in this section are responsible for washing of bed sheets and night dresses of patients. In the process of removing the materials they are exposed to discharges from the patients.

2. **Agriculture/Veterinary**

Agriculture covers such area as cultivating the soil, growing crops and raising livestock. It encompasses the preparation of plant and animal products for the use of people. Veterinary describes the work of a person whose job is to treat sick or injured animals. Contact with certain plants, plant materials or fungi may cause non-infectious poisoning, stinging, allergic reaction (e.g. anaphylaxis, mushroom workers' lung, and bagassosis in the sugarcane industry), and irritant-contact dermatitis (New-Martin, 2012).

Zoonosis is an infection that is transmitted from vertebrate animals to humans. Pathogens of zoonosis are bacteria, virus, fungi, protozoa, helminth and rickettsia. Zoonotic diseases are rabies, brucellosis, tetanus, encephalitis.

Workers who work in agricultural sector of the economy can contact the diseases. Particularly, those whose work involves contact with animal are at risk of exposure to biohazards.

3. **Waste Management Sector**

Waste management activities are collection, transportation, treatment and disposal of waste. People who are engaged in the activities of collecting waste from houses and street are at the risk of exposure to biohazards.

4. **Personal Services Sector**

Personal service describes a service based on the intellectual or manual efforts of an individual. Thus, people involved in making tattoo, manicure and pedicure, hair dressing, including beautician and commercial sex workers are all personal service providers. The personal service providers during the process of doing their job can have contact with human blood. Personal service job can expose providers to biohazards therefore, adequate precaution should be taken by using appropriate personal protective devices.

(iii) **Chemical Hazards**

Basically, a chemical is a substance consisting of matter in the form of solid, liquid and gas. Chemical hazard is a substance that is capable of causing harm to human and animal health. Chemicals are widely used in workplaces. Large number of workers are

directly or indirectly exposed to chemical hazards in workplaces. Meanwhile exposure to hazardous chemical substances can cause serious damage to human health.

Routes of Exposure to Chemical Hazards in Workplaces

Exposure route to hazardous chemical in workplaces can be through inhalation, ingestion, skin contact and injection.

Inhalation: It is the breathing in particles. Inhalation is about the most common means by which hazardous chemical substances can get to human body. Gas, vapour, mist, dust, fumes and smoke can be inhaled and particularly worker's job which involves physical work are at higher risk of inhaling hazardous chemical substance especially when working in the area where the air is polluted.

Ingestion: Ingestion is the process of taking food or drink into the body by swallowing or absorbing. Through the process, hazardous chemicals can get into human body.

Skin Contact: Exposure of skin to hazardous chemical can occur in the case of workplace injury with such chemicals as bleach or drain-cleaners. Local irritation to the affected area occurs due to chemical exposure. Chemical absorbed through the skin in most cases can result in poisoning. Eyes as a delicate part of the body when exposed to chemical can cause irritation and result into possible loss of vision.

Injection: Hazardous chemical can gain entry into the body by been injected into the skin when an individual is punctured by a sharp object such as needle or nails.

Chemical Hazard Exposures in Workplaces

In workplaces workers are exposed to different hazardous chemical substances. Chemical hazards are many both in workplaces and homes. WHO (2001) classified chemical hazards into (1) gases and vapours (2) metals (3) organic (4) organic solves and (5) pesticides.

1. **Gases and Vapours**

   Gases and vapour: They disturb free intake of oxygen needed for survival. Gases and vapour can be categorized into three viz (i) Asphyxiants (ii) irritate gases (iii) organometallic compound and (iv) anaesthetic vapours.

(i) **Asphyxiants** – The major menace of asphyxiants is that they interfere with oxygen exchange in the body. They can cause asphyxia by replacing oxygen. Specifically, simple asphyxiants replace oxygen e.g., nitrogen, methane, hydrogen and carbon dioxide. Chemical asphyxiants interfere through some chemical actions with the respiratory function of the blood, tissue cells or respiratory centre e.g. carbon monoxide (CO), hydrogen sulfide

and hydrocyanic acid. Workers can be exposed to asphyxiants in engine rooms and workshops or another places in the industrial setting which is filled with exhaust fumes.

(ii) **Irritant Gasses** – Irritant gases can cause irritation or inflammation of the mucous membrane with which they come in contact. Highly soluble like ammonia affect the upper respiratory pages. The irritant gases found in workplaces are sulfur dioxide, ammonia, hydrogen fluoride, ozone, chlorine and nitrogen oxides.

(iii) **Organometallic compounds** – Example of the compounds is Arsine (ASH_3) which is produced during treatment of metals when arsenic is present as an impurity and nascent hydrogen is evolved. Exposure results in haemolysis, anaemia, jaundice and anuria in severe cases.

(iv) **Anaethetic Vapours** – this comprise of vapour from gases of methane ethylene and acetylene. Workers most affected are those producing or using industrial gas, cooking gas and welders using acetylene flames to cast metals. Exposure can cause unconsciousness. Workplace should be ventilated or steamed respectively.

2. **Metals**

In industry, poisoning with metals usually takes the chronic form and results from the absorption of small amounts over long periods of time. Metals and their compounds are introduced to the body through inhalation, ingestion and skin contact. Important metallic compounds used in industries are lead, mercury, manganese and arsenic.

(i) **Lead**: Exposure to inorganic lead compounds occurs in mining, extraction, smelting, metal cutting manufacture of lead pipes, lead paints, manufacture of lead batteries, crystal glass and hot metal typesetting. Exposure can cause abdominal pain, anaemia, constipation and general weakness. Personal cleanliness, change of clothes, washing facilities and provision of clean areas for eating and storing food will reduce uptake of lead by mouth.

(ii) **Mercury**: Exposure is possible in mining, extraction, chemical laboratories, pharmaceutical industry, the manufacture of thermometers and barometers, the explosive industry, the manufacture of mercury, vapour lamps, the manufacture of pesticides, mirrors and in dentistry.

(iii) **Manganese**: Workers can be exposed to manganese in mining, extraction, the steel industry, the dry battery industry, the glass and ceramics industry, the manufacture of welding rods and in the chemical industry. Manganese exposure can cause pneumonia and can affect the central nervous system causing Parkinson diseases, tremor, mask face, rigidly and personality change.

(iv) **Arsenic:** Arsenic compounds are used in pesticides, wood preservatives, medicines, paints and the chemical industry.

Exposure to arsenic can cause shock, gastroenteritis, skin lesion, skin cancer, anaemia and lung cancer.

Organic Solvent

Solvent is a liquid in which other substance dissolve to form solution. Organic solvents are carbonated substances. They are liquids in which other substances can be dissolved without changing their chemical composition. Organic solvents are used in the extraction of oils and fats in the food industry, dry cleaning, printing and dying in textile and rayon industry.
The chemical groups are hydrocarbon solvents; alcohols and ethers. Ketones, esters and glycols and their compounds. As a group, solvent affect several of the body's systems and can cause the following effects:

* Nervous system: dizziness, unconsciousness and death, peripheral neuritis, affection of vision, insomnia, headache and easy fatigue.
* Gastrointestinal system: dyspepsia, anorexia and nausea and may be secondary to liver affection.
* Respiratory tract: May show upper respiratory irritation in some cases
* Kidney: affection may cause nephritis or renal failure
* Blood forming organs may be affected causing anaemia or even leukaemia.
* Skin: may show contact dermatitis or acne.

Pesticides

Pesticides are group of chemicals used to destroy various kinds of pests including insect, rodents, weeds, snails, fungi etc. Pesticides are used at homes and in the farm. Exposure to pesticides occurs in industries where the pesticide are manufactured and formulated, and during their application in agriculture. Pesticides are classified into several groups according to their chemical composition.

- Organochlorine. Examples are DD-aldrin, dieldrin, toxafene and gammaxame.
- Organophosphates. These include parathion, methl parathion, malathion and tetradeihipytophosphate
- Pyrethroids. These are synthetic pesticides of low toxicity urea in homes.

Pulmonary Dust Diseases

Dusty atmosphere in the industry will make worker to inevitably inhale dust particles. Although respiratory tract has certain defence mechanism

against dust but when the environment is very dusty a significant amount of dust can be retained in the lungs.

Kinds of dust and their effects

i. Soluble particles of toxic compounds reach the blood and cause poisoning e.g. lead
ii. Irritant dusts cause irritation of the upper respiratory tract and the lungs and certain metal fumes cause chemical pneumonia e.g., cadmium, beryllium and manganese.
iii. Metal fume fever is caused by inhalation of fumes of zinc and copper causing fever, body aches and chills for 1-2 days.
iv. Pneumonia anthrax is caused by inhalation of wool dust containing the spores.
v. Benign pnuemoconiosis which causes X-ray opacities (nodulation without symptom or disability is caused by inhalation of iron, barium and tin dust.
vi. Byssinosis is caused by prolonged exposure (7-10 years) to cotton dust in textile industry. Chronic bronchitis, emphysema and disability are common complications.
vii. Pneumoconiosis is disabling pulmonary fibrosis that results from the inhalation of various types of inorganic dust such as silica, asbestos, coal talic and ching clay, e.g. silicosis and asbestosis.

Silicosis, Silicosis occurs as a result of inhalation of repairable particles of free crystalline silica. Exposure occurs in mining and quarrying operations stone cutting and shaping, glass and ceramic manufacture, sandblasting and manufacture of abrasive surfs. It takes many years to develop the disease (7-10 years), sometimes less and this depends on the concentration of the dust at workplace, its silica content, the particle size and on individual susceptibility. Complication includes pulmonary tuberculosis and cardiac or respiratory failure.

Asbestosis. It is caused by inhalation of asbestos fibres. It is a hydrated magnesium silicate which is resistant to heat and many chemicals. Asbestosis can occur in mining and extraction. Exposure can also occur in its use for insulation, in the making of asbestos cloth, in the manufacture of asbestos cement, pipes and other products, vinyl floor, tiles and in brake and cloth lines. Asbestos fibres, when inhaled will cause diffuse interstitial fumes fibrosis of the lungs, pleural thickening and calcification. The health effects and bronchogenic carcinoma or pleural and peritoneal mesothelioma. The early symptoms include progressive dyspnea or exertion cough, chest pain, cyanosis and clubbing of the fingers.

Prevention and Control of Chemical Hazards

i. Elimination or the substitution of all chemicals that are thought or known to cause illness and or death.
ii. Reduce time which a worker is exposed to chemical hazards.
iii. Workshop should be well ventilated allowing for cross ventilation.
iv. Establishment of work schedule in which workers will have rotating assignment so that all workers will have limited exposure to chemical hazards.
v. The use of personal protective equipment to prevent exposure to chemicals through the routes of exposure –inhalation absorption through skin and/or eyes, ingestion and injection.

(iv) **Mechanical Hazards**

Mechanical has to do with the machinery. It is production and operation by machines or tool. Hazard exposed to when machine is being operated using human hand or electric power is called mechanical hazard. In industries machines are used in the process of producing goods and services by workers. Accident do occur due to improper way of operating machine or operating faulty machines. Essentially, mechanical injuries do occur as a result of a work being contacted or entangled with machinery. Particularly such parts of machinery that could expose worker to hazard are hot surface, moving parts, pulley, sharp edges etc. In brief poor knowledge of the hazards associated with machinery a worker is operating remain a significant factor that predispose him/her to mechanical hazards.

Common Mechanical Injuries in Industry

Some injuries that commonly occur in industries as a result of the exposure to mechanical hazards as identified by Edet (2019) are briefed below:

i. **Fracture**: Fracture is otherwise called broken bone. It can be classified as simple, compound or complete fracture.
ii. **Puncturing/Stabbing:** Puncturing results when an object penetrates straight into the body and pulls straight out, creating a wound in the shape of the penetrating object.
iii. **Straining and Spraining:** A strain results when muscles are overstretched or torn. Strains and sprains can cause swelling and intense pains.
iv. **Impact:** Being hit by ejected parts of the machinery or equipment.
v. **Friction and abrasion**: A section of the skin being rub away by the machine.

vi. **Entrapment:** Being caught in a moving part of a machine or equipment or plant.
vii. **Crushing:** Collision of plant with a person can result in crushing.
viii. **Shear:** This can be as a result of two moving parts (sharp or otherwise) moving across one another.
ix. **High pressure injection**: This is an injury caused by high-pressure injection of oil, grease, diesel, fuel, gasoline, solvents, water or even air, into the body.
x. **Severing of a human body part** as a cutting motion e.g., amputation.

Health education programme to acquaint the workers with hazards associated with each job and machinery should be put in place. Also, provision and use of personal protective equipment should be encouraged.

(v) **Ergonomic Hazards**

Complex relationship exists between all job activities and workers experience of physical and psychological stress. Stress of whatever form compromise the health and wellbeing of workers in industrial settings. Injury and accident occurrence increased human error. Ineffectiveness and inefficiency are as a result of the fact the workers are under stress. The problem that comes as a result of mismatch between job and physical and human mental abilities as well as limitation has given rise to the study of ergonomics. Ergonomics endeavour to fit job to worker's ability. Ogundele and Okeke (2018) posited that ergonomics deals with the interaction between human and such additional environmental elements such as heat, light, sound, atmospheric contaminants and all tools and equipment pertaining to the work place. In ergonomic, work stations tools and job are designed to ensure safety, efficiency and wellbeing of workers. In this way job satisfaction and high productivity will be achieved.

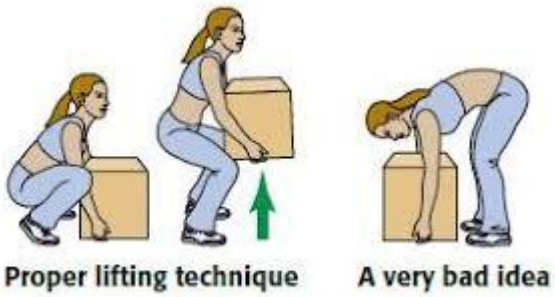
Ergonomic hazards are physical conditions in the workplace that predispose workers to bones damage to knees, ligament of lower back, nerves of hands all leading to disorder of musculoskeletal system. The major hazard includes, eye strain, poor body carriage, vibration, poorly designed office furniture, frequent use of force, poor way of lifting, poor repetitive movement.

Prevention of Musculoskeletal Disorders

Improper way of lifting heavy load is a major cause of musculoskeletal disorder. According to Oladipo (2008) stooping with the back arched and with the load end of the arm causes injuries. Lifting in this manner puts much strain at the point of the bend of the back where the muscles lack the strength to bear the load.

Simple rules for lifting put forward by Oladipo (2008) are briefed below:

- The spine should be held in an erect position as possible.
- The weight/load should be lifted close to the body.
- Either both feet or one knee and a foot should be placed firmly on the floor close to the object.
- The knee and hips should be bent.
- The main pressure required to lift the object is applied by straightening the legs and the hips.
- The body should never be twisted with the load.



Source: www.googleimage.com

(vi) **Psycho-Social Hazards**

Psycho-social comprises of psychological and social aspect of a person in relationship to his/her health status. The design, organization and management of work in an industry determine to greater extend the well-being of workers. In industry, tight work schedule, lack of job satisfaction, insecurity, poor remuneration, poor interpersonal relationship between management and worker, hazardous work environment continues to undermine the both psychological and social health of workers. Exposure to psycho-social hazard can lead to physical, emotional and mental exhaustion. Psycho-social hazards can cause psycho-somatic ill-health. This is because affected worker can suffer from such psychological illness such as depression and anxiety disorder and physical ill-health such as musculoskeletal injury, headache and pain in the shoulder. Workers exposed to psycho-social hazards may exhibit such psychological and behavioural changes as alcoholism, drug abuse, absenteeism, tardiness, aggressiveness and hostility.

Factors that continue to increase exposure to psychosocial hazard are harsh socio-economic situation, chaotic family life, heat, noise and poor infrastructural development. The likelihood of increased stress among worker is high. This is because of the envisage challenges that come with products of technology regarding their operations as well as effect nuclear energy which continue to increase psycho-social health problems.

However, exposure to psycho-social health problems can be brought to the barest minimum given the following measure

- Improved work design
- Good organizational structure in industries
- Remuneration commensurate with job performed
- Health-promoting industrial environment
- Good interpersonal relationship between management and workers'
- Effective industrial health programme.

SELF-ASSESSMENT EXERCISE

State five identified industrial hazards.

4.0 CONCLUSION

Existence and prevalence of hazards associated with job and machinery in the industrial establishments in the country have be established. Hazard is associated with industrial injuries and diseases including various forms of disorder. Hazards have been known to reduce the capacity of workers to perform maximally in order to produce quality and quantity goods and services in industrial settings. In industrial establishment hazards cannot be totally removed but it exposure can be reduced among workers. In this unit effort was made to discuss the identified hazards in industrial establishment.

5.0 SUMMARY

Hazard is a situation with the potential for harm regarding injury or ill-health to human body. Industrial hazard is anything in the industrial environment or work process that can cause ill-health. Types of industrial hazards are physical, biological, chemical, mechanical, ergonomics and psychosocial.

6.0 TUTOR-MARKED ASSIGNMENT (TMA)

1. Describe hazard and industrial hazard.
2. State five identified industrial hazards.

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UNIT 2 INDUSTRIAL HAZARD IDENTIFICATION: PROCESS AND IMPORTANCE

CONTENTS

1.0 INTRODUCTION

Industrial hazards when left unattended to can cause the establishment to loose so many things that can be of benefit to the industry. Industrial establishments cannot but have hazard. It is the responsibility of the management to find a way of controlling and preventing the problem that can emanate from the hazard. It is therefore important that hazards in industrial setting be identified for the purpose of controlling and preventing them. The management and the workers as well stand to benefits immensely from the identification of hazards in industrial establishment. However, in controlling and preventing industrial hazards. Specific measures should be adopted.

2.0 OBJECTIVES

By the end of this unit, you should be able to:

- Identify consequences of exposure to industrial hazards.
- State processes of industrial hazard identification.
- Mention importance of industrial hazard identification.
- Explain measures for preventing and controlling industrial hazards.

3.0 MAIN CONTENT

3.1 Consequences of Exposure to Industrial Hazards

Hazard has been identified as a situation that is capable of presenting harm regarding injuries or diseases to human body. Industrial hazard is any substance in industrial setting or work process that has the potential of causing ill-health to workers. It is the exposure to hazard that is harmful. Therefore, harmful effect of industrial hazard can be prevented only if its exposure is avoided. Failure to identify and avoid exposure to industrial hazard can present grave consequences. However, in most industrial establishments measures to prevent exposure to hazard are ignored and the following consequences ensued.

i. Exposure to hazard in industrial establishment can lead to injuries and diseases on the path of workers in the process of work. For instance, exposure to electrical energy can lead to electrocution, burns and shocks among such categories of workers as electricians, construction workers and users of electric hand tools. Also, fire fighters, steel workers, and smelter workers exposed to thermal energy can experience heat strain. Exposure to extreme cold can result in hypothermia.
ii. Experience of diseases and injuries among workers can lead to increased medical treatment cost. Frequent visit to hospital to be treated after sustaining injuries or contracting diseases can also lead to increased absenteeism. Amount paid for treatment as well as the time a worker is absent from work all constitute loss to the industry. Thus, it is rather cost effective to prevent the exposure to hazard than to allow hazard to wreak havoc and address the consequences.
iii. Exposure to industrial hazard that leads to injuries and diseases poor performance at work. Maximal performance of workers that result into production of quality of goods and service depends largely on improved state of health of industrial workers. An industrial worker who is psychologically disturbed as a result of work overload, poor environmental work place condition, poor remuneration, unhealthy interpersonal relationship at workplace will certainly not be able to put in his/her best at work.
iv. Exposure to high degree of industrial hazard can predispose worker to commit grievous error that can lead to accident. Industrial worker that is made to work in too hot or too cold environment may make mistake. Also, a worker that is psychologically indisposed can lose concentration and thereby committing error. A worker that is fatigued due to pressure of work is bound to commit error that can eventually lead to accident.

v. Optimal performance of worker that can lead to high production out can be hampered by disease as a result of exposure to hazard. Eye strain, musculoskeletal disorders and headaches can be experienced by worker as a result of exposure to ergonomic hazard.

vi. Ability to deal with emergencies depend largely on worker's fitness physically, mentally, emotionally and socially. Fitness of an individual worker can be weakened by diseases as a result of exposure to hazards.

vii. High quality of work done by worker enhances the image of an industry. In fact, manager of industry is interested in high quality goods and services that can fetch the industry money. However, exposure to hazard which can lead to disease can affect negatively ability of workers to work maximally in order to produce quality goods and services which can make people to continue to give due recognition to the industry.

viii. Quality goods and services produce by industry no doubt contributes to economy development of a nation. This role can be hindered by failure of worker to work to fullest capacity as a result of ill-health occasioned by exposure to hazard in an industry.

ix. Diseases when continue to be contracted as a result of regular exposure to hazards can affect negatively ability of industry to retain workers in the industry for long. This is because no worker would want to work for long in a place where his/her health continue to be affected.

x. Exposure of workers to hazard which can predispose worker to illness and eventual poor performance resulting in poor product of industry can expose the industry to lawsuits. This is because customers who got disappointed as a result of substandard goods and service bought from industry can go to court for redress. Again the image of the industry is at stake also loss of money involved can put an end to the existence of the industry.

3.2 Process of Industrial Health Hazard Identification

(i) Study the industrial environment and job activities and how they affect the workers' health.

(ii) Study the results of periodic health examination of workers.

(iii) Study the common causes of ill-health condition as reported by workers.

(iv) Study the common causes and rate of accident in the industry.

(v) Thorough inspection of all the departments in industrial establishment with the effective use of check-lists can help to identify industrial hazard.

(vi) The study of the reports on general inspection of work place machinery and effect on workers' health that are usually embarked

upon by labour unions to protect the health of their members can be studied to identify industrial hazards.

(vii) Gather and study information through researches regarding common causes and effects of industrial health problems.

3.3 Importance of Industrial Hazard Identification

Identification of a problem in any situation is an important step toward solving the identified problem. Thus, identification of hazards in industrial establishment can be helpful in providing solution to the health problem that result from the exposure to hazards.

1. Injuries and disorder as a result of exposure to industrial hazard on the part of worker can be prevented when hazards are well identified and avoided.
2. Well identified industrial hazard can be prevented. Thus life and resources that may be lost as a result of the consequences of exposure to such hazard can be saved.
3. Identification of hazard associated with job in industrial establishment can to a greater extent acquaint the workers with the hazard so that its exposure can be prevented.
4. Identification of hazard can help to locate factors in the industrial environment that constitute threat to workers' health for possible controlling measures to be taken.
5. Substances and activities that are hazardous to workers can be avoided with the identification of industrial hazards.
6. Identification of industrial hazard can help to gather information regarding level of hazardous substances in the industry.
7. Identification of hazards in an industrial establishment can help to obtain data as to the effect of exposure to job hazard on the health and well-being on workers.
8. Identification of hazard in an industrial establishment helps to mitigate the effect exposure to hazard. This should be the last resort and should be adopted only when exposure is cannot be totally divided.

3.4 Measures for Preventing and Controlling Industrial Hazards

Exposure to hazards has been known to cause accident and disorders that can be detrimental to the health and wellbeing of workers. The presence of hazard in workplace may be inevitable therefore the other useful option is to prevent exposure to such hazard already identified. The basic activities identified by experts to prevent and control industrial hazards include the following:

1. Educating workers to be aware of hazard associated with their job. Also, training workers to ensure that they observe strictly job procedure so as to prevent identified hazards.
2. Enclosing or guarding hazard at its source to prevent the release into the air can help to control hazard.
3. In industrial establishments hazards are associated with machine methods, material and or facility structure. These hazards should be identified for the purpose of eliminating them.
4. In cases where hazards associated with machinery and work process cannot be avoided, personal protective devices should be provided by the management and put to use by worker in order to shield the worker from the identified hazard.
5. Matters relating to health and safety of workers should regularly be discussed at staff meetings. The management of an industry should be updated with safety and health problems and other matter that are related to accident prevention in the industrial establishment.
6. In Nigeria, Standard Organisation of Nigeria (SON) develops and publishes safety standards both for production facilities, (equipment, work process and tools) and for product. The Standard should be applied on industries by workers. Also, there should be thorough supervision to ensure that the standard is followed.
7. Health and safety inspection programme should be developed for the industry. The programme should be implemented by supervisors and field safety performed in order to locate hazards at the workplace and those associated with the use of the goods and services in the industry.
8. Inspection of new machines, equipment and tools should be carried out regularly to ensure that they have health and safety safeguards.
9. Training of workers to follow in the job process health and safety principles and techniques.
10. Every industrial accident occurrence should be thoroughly investigated to determines the causes and costs with a view to preventing the re-occurrence.
11. Investigate all anomalies in the industry that resulted in injuries and disorder for the purpose of effecting corrective measures.
12. In industrial establishment, fire-fighting equipment and first aid equipment must be made available to deal with emergencies.
13. Training programme must be put in place to increase the competence of workers in handling their job.
14. The employers and employees should take responsibilities of ensuring the health and safety of workers in industrial establishments.

15. General cleanliness of the workplace must be ensured. It is important to control the rise of dust when sweeping to prevent its injurious effects by keeping the workplace wet. Also regular disposal of waste, refuse and sewage) is important to prevent occurrence of environmental health disease.
16. Regular handwashing should be practiced by all workers. It is very important that workers who handle toxic substances such as lead or those that handle dusty substances or dirty materials should wash their hands with water and soap to prevent contracting diseases.

SELF-ASSESSMENT EXERCISES

i. State the importance of health hazard identification.
ii. Mention any 5 measures for controlling and preventing industrial hazards.

4.0 CONCLUSION

Hazards are widespread in industrial establishment. Exposure to hazards leads to injuries diseases and disorders which continue to negate the health and wellbeing of workers. Workers' work-out-put can be negatively affected by exposure to hazards in the industry. It is therefore important that the problem of exposure to hazards be sufficiently addressed. The first step towards the achievement of exposure to industrial hazard is identification of hazard in the industry. This is closely followed by identification of specific measures for prevention and controlling hazards in industrial establishment.

5.0 SUMMARY

- Exposure to hazards in an industry present injury, disease/disorder or death to workers. Consequences of exposure to hazard in industrial establishment are increased medical cost as a result of frequent visit to hospital due to ill-health, increased absenteeism, increased accident occurrence, poor quality of goods and services induced and low physical fitness of workers.
- Process of hazard identification include: study the report of periodic medical examination of workers, examining the workplace environment to identify hazards, study the worker's ill-health complaint and conducting simple research regarding health status of workers.
- Identification of industrial hazard helps to prevent the consequences of hazards which may be grievous.
- Measures for preventing and controlling hazards in an industry include: creating awareness regarding existence and nature of hazard in the industry through effective health education.

6.0 TUTOR-MARKED ASSIGNMENT

1. Describe any 5 consequences of hazards in industrial establishment.
2. State the processes of health hazard identification.

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UNIT 3 INDUSTRIAL TOXICOLOGY

CONTENTS

1.0 INTRODUCTION

Chemical substances are used for the production of goods and services in industry. The chemical substances can present hazard to human body only when an individual is exposed to sufficiently high concentration of the chemical. Meanwhile exposure to a chemical to a level of being hazardous can lead to health problem which can render worker incapacitated. It is therefore, important that portal of entry as well as factors influencing the toxicity of chemical be identified in order to avoid its exposure.

2.0 OBECTIVES

By the end of this unit, you should be able to:

- Define toxicity
- Describe points of entry of chemical substance into human body.
- State factors influencing the toxicity of a chemical substance.

3.0 MAIN CONTENT

Industrial Toxicology is a field of science endeavour that provides knowledge of injurious effect of chemical or situation on workers. It is an important aspect of industrial safety which studies poisons and harmful effect of exposure to chemical material to a greater level in an industrial setting.

Industrial chemical substances are extensively available and used putting workers at the risk of been exposed to the substance. However, knowledge of toxicology has made one to understand that differential

response to substance being exposed to exist. Also, amount of concentration and duration of exposure have effect on responses. According to Environmental Health and Safety (2020) toxicology provides critical information and knowledge that can be used by regulatory agencies, decision makers and other to put programmes and policies in place to limit our exposures to these substances, thereby preventing or reducing the likelihood that a disease or other negative health outcome would occur.

3.1 Definition and Types of Toxicity

The definition and types of toxicity as identified by SlideShare (2012) are as follows:

Toxicity has been defined as any harmful effect of a chemical on a target organ.

Major types of health effects caused by toxic substances may be:

- **Systemic toxicity** - serious, sometimes fatal poisoning that may occur after contact with certain organophosphate pesticides, ingestion of high dose of tranquillizer drugs or inhalation of organic solvents.
- **Organ toxicity** - certain chemicals have a target organ specificity (harm a certain organ rather than others) often because of biotransformation or bioconcentration. The route of exposure might also be responsible for specific organ injury.
- **Liver toxicity** - most chemicals are metabolized in the liver. Therefore, the liver becomes a target organ for many substances. Organic solvents (ethanol), certain trace metals (copper, cadmium) often cause extensive liver damage.
- **Kidney toxicity** - many xenibiotics are removed by glomerular filtration and tubular excretion, while essential elements are reabsorbed in the tubuli. Agents with kidney toxicity include metals (e.g. mercury, cadmium, lead) and drugs (sulphonamides). Neurotoxicity functional or organic alterations of neurotransmitters can cause symptoms of paralysis (organophosphates, chlorinated organic compounds, metals etc.).
- **Skin toxicity** - allergic reactions can occur in sensitive individuals while skin irritation can occur in anyone exposed to a wide variety of irritating chemicals.
- **Immunotoxicity** - the immune system ensures (1) non-specific defense mechanism against agents, for which no previous sensitization occurred, and (2) specific, adaptive mechanism directed against specific agent, for which the organism has previously been sensitized or infected.

- **Genotoxicity** - chemical agents can interact with structure and function of DNA, leading to alteration of genetic codes and information. This process involves gene mutation, chromosomal alteration (structural and numerical) and/or gene rearrangements.

3.2 Routes/Portal of Entry for Toxic Substance

The identified routes of entry for toxic chemical are inhalation, dermal exposure, injection.

1. **Inhalation**: In an industrial environment such toxic materials as dust, fume, gas and mist can be inhaled. Long working hours and ability of substances to travel in the air makes inhalation to the most important route of entry.
2. **Dermal exposure:** Dermal exposure result from skin contact with contaminated substances in the environment such as water, dust and sediment, it occurs when toxic material is absorbed through the epidermis and enter into blood stream. The chemical that may be absorbed through the skin include mercury, acrylates, steroids, isocyanates.
3. **Ingestion**: It is the process of taking chemical substances through food, or water by swallowing. Ingestion is accomplished by taking in food, drinks and medicine through mouth into the gastrointestinal track. Worker can ingest toxic substance by eating contaminated food material in the workplace.
4. **Injection:** It is the act of administering a liquid substance into a person's body. Such substances as medication, fluids or nutrient directly into human body. Disease can gain entry into human body through the use of contaminated needle to inject a person.

3.3 Health Effect of Toxic Chemical

Effect of toxic substance affect gain entry into the body can be acute (immediate)or chronic (long term)

1. Toxic substance that can cause cancer in human body include benzene, arsenic, and nickel beryllium.
2. The main effect of carbon tetrachloride is liver damage.
3. Ammonia and nitrogen dioxide cause aggravation of any tissue that the substance come
   in contact with in human body.
4. Chemical substances such as carbon monoxide, hydrogen cyanide methane and hydrogen sulphide produce depletion of oxygen to the tissues in human body.
5. Internal damage can be done through the activities of hepatotoxic agent. Also, liver can be damaged by halogenated hydrocarbons.

3.4 Factors Influencing Toxicity

The identified factors influencing toxicity include the following:

1. **Dosage**: It determines whether a substance will be an acute or a chronic toxicant. Nearly all chemical substances can be acute toxicants if sufficiently large doses are administered.
2. **Exposure route:** Exposure route remain determinant of toxicity. This is because some chemicals may be rightly toxic by one route but not by other.
3. **Absorption**: Ability to be absorbed determines toxicity. This is because some chemicals are readily absorbed and other are poorly absorbed.
4. **Innate chemical activity:** The innate chemical activity of substances varies. Some can quickly damage cells causing immediate cell death, others slowly interfere only with cells function.
5. **Gender**: Physiologic differences between men and women including differences on pharmacokinetics and pharmacodynamics can affect drug activity.
6. **Metabolism**: It is the conversion of a chemical from one form to another by a biological organism. There are two types of metabolism (i) Detoxification (ii) Bioactivation. In detoxification, axenobiotic is converted to a less toxic form. In bioactivation, axenobiotic may be converted to a more reactive or toxic form.
7. **Distribution within the body:** A major determinant of whether a toxicant will damage cells is its lipid solubility. If a toxicant is lipid-soluble, it readily penetrates cell membrane.

SELF-ASSESSMENT EXERCISE

i. State the health effects of toxicity.
ii. What are the factors influencing the toxicity of a chemical substance?

4.0 CONCLUSION

Toxic chemical is one of the hazards in industrial. Exposure to the hazard presents health problems. Preventive measures against the exposure starts with having the knowledge of how the chemical find its way into human body and how the toxic substance affect the body.

5.0 SUMMARY

In this unit, we have learnt that:

- Toxicology provides knowledge of injurious effect of chemical substances on a person. Toxic chemicals are substances that at injurious to human body upon exposure.
- Routes of entry for toxic substances include inhalation, dermal exposure, ingestion and injection.
- Harmful chemical substance can damage liver, cause aggravation of any tissue and produce depletion of oxygen to the tissue.
- Poising also known as toxicity is the effect of toxic exposure. Determinants of toxicity are dosage, route of exposure and gender.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define toxicology and toxicity.
2. What are the routes of entry of chemical substance into human body?

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MODULE 4 INDUSTRIAL HEALTH PROBLEMS

UNIT 1 SOCIAL HEALTH PROBLEMS OF INDUSTRIALISATION

CONTENTS

1.0 INTRODUCTION

The benefit accruing from industrialization is not without some health consequences. Thus, increase in population as a result of the fact that many young people will be attracted to industrial community by job opportunities that abound will bring about such problems of pollution, increase in crime rate, overstretched health facilities, inadequate dwelling places, stress and increase in accident occurrence both in the community and in the industrial premises. In this unit learners will be introduced to health problems community encounters as a result of industrialization also the problem of accident occurrence in industrial setting.

2.0 OBJECTIVES

By the end of this unit, you should be able to:

- State problems the community people will encounter as a result of industrialization
- Identify and explain causes and prevention of industrial accident.

3.0 MAIN CONTENT

3.1 Community Problems Owing to Industrialization

The unprecedented establishment of industries where highly technical skills and sophisticated technology are used to produce improved goods and services often lead to large scale business activities in an area is termed industrialization. The benefits that come with industrialization are many. More people will be attracted to an industrial area hence increase in population, use of products of advanced technology, urbanization, employment opportunities and increased social contact. However, there are social health consequences such as increase in energy consumption, waste generation, overstretched health facilities as a result of disease occurrences, together with increased shortage of dwelling places. Park, (2009) identified the following as the problems community people will encounter as a result of industrialization.

(1) **Environmental sanitation problems:** Inadequate housing together with living in unsanitary environment remain common in industrial area. This is because many young people who migrated from rural areas to urban area in search of factory jobs. Also, water pollution is one of the tragic aftermaths of rapid industrialization due to discharge of industrial wastes without treatment, into water courses. Industrial wastes may contain acids, alkalis, oils and other organic and inorganic chemicals, some of which may be toxic; synthetic detergents and radioactive substances. Air-pollution is an important problem in industrial areas. Air pollution is due to the discharge of toxic, fumes, gases, smoke and dusts into the atmosphere. Poor sewage disposal due to lack of facilities for the disposal of sewage leads to pollution of water supply.

(2) **Communicable Diseases:** The main problems in industrial areas are tuberculosis, sexually transmitted infections, and food and water borne infections. Industrial areas without proper sewage disposal have become hot-beds for filariasis owing to the breeding of the mosquito vectors in contaminated water.

(3) **Food contamination:** The standards of food sanitation are bound to be lowered due to industrialization, if proper precautions are not taken. The identified food infection are typhoid fever and viral hepatitis.

(4) **Mental Health:** Mental health problems are due to altered living conditions. Young people who migrated from rural areas are introduced to new environment. They have to adjust to the new environment failure of adjustment leads to mental illness, psychoneurosis, behaviour disorder and delinquency

(5) **Accident:** Accidents are a public health problem in industrial areas due to congestion, vehicular traffic and the increased tempo of life.

(6) **Social Health Problems:** The identified social health problems as a result of industrialization are alcoholism, drug addiction, prostitution, juvenile delinquency, and higher incidence of crime.

(7) **Morbidity and Mortality:** The industrial areas are characterized by higher rate of morbidity and mortality compared with rural areas. This is because such diseases as chronic bronchitis and lung cancer are common in industrial areas.

3.2 Industrial Accident

Accidents are events not thought out thereby beating victim's imagination and leading to damage to property, bodily harm or death. Industrial accident is occurrence of accident at workplace the aftermath of which include damage to tool and machinery including bodily injury or death. Accident has been widely described as unplanned, sudden and unintended event. However, observation has shown that industrial accident occurs as a result of the presence of certain factors which the management and worker are not aware of previously. Specifically, the identified factors are risky industrial environment and workers' characteristics. In this context, risky environment would mean unsafe workplace surrounding which include faulty tools and machinery and workers characteristics which include his/her knowledge as well as physical, mental and emotional fitness. The acceptance of these factors as predisposing indices spurs us to admit that accident should be envisaged in industrial settings and should be planned for well head of the occurrence.

The types of accident that commonly occur in industrial setting as identified by Park (2009) are briefed as follows:

- falls or being struck by materials
- striking against objects
- being caught in, under or between objects
- over-exertion or strenuous movements
- exposure to or contact with extreme temperatures
- exposure to or contact with electric current
- exposure to or contact with harmful substances or radiation

Causes of Accident

In line with our earlier postulation that accident should be envisaged and planned for there is need to have the record of causes of accidents for inclusion into health and safety industrial programme. Specifically,

human factors, mechanical factors and environment factors have been identified as causes of industrial accident by the experts.

Human Factor

Human related factors are sometimes responsible for occurrence of accident in industrial setting. Oladipo (2009) identified the following human factors in the causation of industrial accident

(a) **Poor knowledge as regards hazard associated with job:** Accident do occur in industrial setting as a result of poor knowledge of workers regarding the operation of machines. Specifically, accident occur because of inadequate knowledge of workers.

(b) **Inadequate Skill**: Inadequacy of required experience needed to function effectively in a job can lead to accident. An inexperienced or unlicensed driver can cause road accident because he/she lack sufficient driving skill. Also, a drop in the level of skill previously possessed as a result of disease, old age, fatigue, emotional disturbance, influence of drug can also cause accident.

(c) **Defective attitudes and behaviours**: Negative attitude towards job performance can cause accident for example poor maintenance of machinery. Also, engaging in distracted driving or operating detective machine can cause accident. Driving while engaging in other activities which distract the driver's attention away from the road can compromise the safety of the driver, passenger and other people as well.

(d) **Physical disability and Physiological factors**: Physical disabilities like amputation, poor vision and auditory impairment can make workers prone to accident. Physiological factors that could lead to accident proneness include fatigue, influence of drugs or alcohol, sickness, poor reaction time and physiological stress.

(e) **Mechanical Factors:** Mechanical factor causing accident can come from the use of faulty machine and misuse or overuse of machine. Poor concentration while operating machine as well as improper dressing while operating machine. Lack of machine maintenance which could lead to the use of machine which part has worn out already can also lead to industrial accident.

(f) **Environmental Factors:** Environmental factors causing industrial accident can come from two sources: natural and manmade. Natural sources are rainstorm, earthquake, thunder, flood, tornado, and flood. Man-made sources include slippery floor, poor lighting and unsanitary environment.

Prevention and Control of Industrial Accident

Industrial accident has been identified to result into damage to tool machinery as well as bodily hurt or death. The need to prevent and control industrial accident cannot be over-emphasised. The measures to follow in order to prevent and control occupational accident as put forward by Achalu (2010) are briefed below:

- provision of safe premises, safe procedures, safe machines for workers by the employer.
- provide workers with adequate training on the importance and proper use of safety devices such as eye goggle, booths, ear plugs, hoes, cutlasses, hands gloves, face mask as the case may be according to factory rules.
- Pre-employment and periodic examination of all employees should be ensured. This is to evaluate the health and fitness status of the employees before employment as a baseline data and also to determine what becomes of the workers' health with time due to the nature of work done.
- Provide workers with information regarding the inherent risks of any occupation before he is allowed to work alone on the job.
- Protective clothing should be properly designed according to the anthropometric measurement of the workers to avoid discomfort while performing tasks.

SELF-ASSESSMENT EXERCISE

What are measures for the prevention and control of industrial accident?

4.0 CONCLUSION

Industrialization can be beneficial to the individual and the community at large because of employment opportunities and increased social contact. However, negative effects of industrialization which include increase in waste generation with its attendant problem of pollution, general increase in social vices as well as overstretching health facilities and other infrastructural facilities can be overwhelming on the community people.

Accidental occurrences have some negative effects on the industrial settings generally. Accident lead to damage of tool and machinery as well as loss of lives. Effective industrial health programme is capable of solving the problem arising as a result of industrialization as well as occurrence of accident in industrial settings.

5.0 SUMMARY

In the unit effort was made to identify benefits of industrialization while greater emphasis was laid on the negative effects of industrialization on the community people. Industrial accident was described as incidence which led to damage to tool and machinery as well as causing bodily injury or death. The identified causes include human factors, mechanical factors and environmental factors. The need to prevent and control current spate of occurrence of industrial accident cannot be overemphasized.

6.0 TUTOR-MARKED ASSIGNMENT

1. Mention and discuss the social health problem community people do encounter as a result of industrialization.

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UNIT 2 DISEASES AND DISORDERS IN INDUSTRIAL SETTING

CONTENTS

1.0 INTRODUCTION

Disease occurrences have continued to have negative effects on industrial settings generally. Disease can render workers ineffective and continue to absent himself/herself from duties as a result of ill-health. The industrial establishment is at the risk of low production and increase in health care costs. This unit focuses on classification of diseases based on target system organ. Also, description of COVID-19 including measures for its control and prevention in industrial establishments.

2.0 OBJECTIVES

By the end of the unit, you should be able to:

- State industrial diseases that are associated with 2 organs and 2 systems
- Describe COVID-19 and measures for its control in work places

3.0 MAIN CONTENT

3.1 Classification of Industrial Diseases

Disease is a condition that is not normal that affect the structure of all or part of an organism. Industrial disease is abnormal condition that negatively affect the structure of all or part of a worker thereby limiting his/her ability to perform maximally. Disease can be classified according to such pathogen as viruses, bacteria, fungi and parasites (protozoa, helminthes and ectoparasites) for the sake of this topic industrial diseases are classified according to target system/organ.

Diseases and Disorders based on target system/organ

1. **Industrial disorders of the nervous system**

Nervous system is the major controlling and regulatory system in the body. It is the center of all mental activity including thought, memory and learning. Nervous system comprises of the brain, spinal cord and nerves. Main organs of nervous system are eyes, taste buds and olfactory epithelium. It is also important to note that sensory receptors for the general senses such as touch, temperature and pain are located throughout part of the body. Disorders associated with nervous system are stroke, meningitis, spinal cord injury, carpal tunnel syndrome, epilepsy, Parkinson diseases, Alzheimer disease and neuralgia.

2. **Diseases of Respiratory diseases**

Respiratory system consists of organs that delivers oxygen to the circulatory system for transport to all body cells. The organs of the respiratory system extend from the nose to the lung and divided into the upper and lower respiratory tracts. The upper respiratory tract consists of the nose and the pharynx or throat. The lower respiratory track includes the larynx, or voice box; the trachea, or windpipe, which splits into two main branches called bronchi; tiny branches of the bronchi called bronchioles; and the lungs, a pair of sacklike, spongy organ. The nose, pharynx, larynx, trachea, bronchi and bronchioles conduct air to and from the lungs. The lungs interact with the circulatory system to deliver oxygen and remove carbon dioxide (Babalola, 2011). Disease that affects the organs of respiratory system are asthma, chronic bronchitis, lung cancer, pneumonia, emphysema, silicosis and asbestosis.

3. **Diseases of the Liver**

Liver is a dark-reddish-brown organ. The anatomical position of liver in the body is immediately under the diaphragm on the right side of the upper abdomen. Liver play major roles in the metabolism and has a number of function in the body including glycogen, storage, plasma protein synthesis, and drug detoxification. It also produces bile, which is important in digestion. It performs and regulates a wide variety of high-volume biochemical reaction requiring specialized tissues (Babalola, 2011). Diseases of the liver include hepatitis and cirrhosis of the liver.

4. **Diseases of Cardio-Vascular System**

Cardiovascular system is the combined function of the heart, blood, and blood vessels to transport oxygen and nutrients to organs and tissues throughout the body and carry away waste products. Diseases of

cardiovascular system are heart failure, hypertension, strokes, arrhythimia, leukemia and anaemia.

5. **Disorders of Integumentary System**
   Integumentary System: Integumentary system is a set of organs.

Specifically, they are located at the upper layers of human body. It consists of skin, nails and hair. Disorders that affect integumentary system are acne, pigmentation, rash, yeast, athletes' foot, sunburn, skin cancer.

Workplace Prevention and Control of COVID-19

COVID-19 is caused by contracting SAR-COV-2. COVID-19 stands for coronavirus disease 2019. According to Jewell (2020) coronaviruses are zoonotic and this means they first develop in animals before being transmitted to humans. For the virus to be transmitted from animal to humans a person has to come into close contact with an animal that has the infection. Once the virus develops in people, coronaviruses can be transmitted from person to person through respiratory droplets. One can acquire SARS-COV-2 by touching mouth, nose, or eyes after touching a surface or object that has the virus on it. SARS-COV-2 can also be passed on via airborne transmission of small infectious particles that may linger in the air for minutes to hours (Jewell, 2020).

Symptoms of COVID-19 are shortness of breath, sore throat, fatigue, headache, defective breathing, chest-pain, and heart failure.

The infection control measures are:

- Frequent washing of hands
- Wearing of face and mouth masks
- Observing respiratory etiquette such as covering mouth while coughing or sneezing or sneezing into elbow.
- Maintaining social distance
- Frequent washing of hands with soap in running water or with alcohol-based sanitizer.

Measures to prevent COVID-19 at Workplace

Industrial environment provides suitable avenue for increased spread of COVID-19. This is because workers interact with one another as well as machinery. Presently there is no cure for COVID-19. Observing control measure remains means by which workers can be protected against the disease. Some control measures guidelines have been put forward by

experts. It is important that the guidelines be adapted to suit each workplace including the work processes.

A. **Engineering Control**

- Structures in industrial environment should make it possible to observe social distancing.
- Encourage the use of natural fresh air. The use of central air conditioning should be discontinued.

B. **Administrative Control**

- Minimise the number of visitors into the premises of the industry.
- The use of Biometric Attendance System which will encourage many people to have contact with the same machine should be discouraged.
- Immediate medical attention should be sought by worker with symptoms of COVID-19. In fact, sick workers should be allowed to stay at home.
- All workers must observe respiratory hygiene.
- There should be frequent sanitation of machines and furniture in workplaces.
- Social distancing must be practiced by workers.
- Eating in groups and sharing food and cutlery should be discouraged.
- As much as possible workers should avoid public transport. Workers can be given accommodation within the premises of the industry.

C. **Personal Protective Devices**

- Workers should be provided and encouraged to use personal protective devices such as shield, face mask, gowns, gloves, and goggles.

SELF-ASSESSMENT EXERCISE

What are the control measures for the prevention of COVID-19 in industrial setting?

4.0 CONCLUSION

Diseases and disorders work against the health and general wellbeing of workers in industries. They constitute hindrance to effective and efficient performance of workers leading to low level of productivity in industrial establishments. Therefore, prevention and control of industrial diseases and disorders become pertinent. Important step towards

prevention and control of health problem begins with identification of the nature and causes of the disease and disorder.

5.0 SUMMARY

In this unit, classification of disease/disorders according to the target system/organ was done. Effort was made to describe the target systems/organ and state the specific diseases/disorder affecting them. Description of COVID-19 including the control measures using engineering, administrative and personal protective devices was done.

6.0 TUTOR-MARKED ASSIGNMENT

Describe any two 2 organs and 2 systems being targeted by diseases.

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UNIT 3 OCCUPATIONAL RELATED HEALTH PROBLEMS

CONTENTS

1.0 INTRODUCTION

Occupation can be literarily thought of as what occupies a person's time. Activity that is justified in terms of profitability that a person engages in is what can be said to be occupation. Activities a person involve himself/herself in order to earn a living can be termed as occupation. The forms of such activity specifically may include productivity, services, trade or craft for the purpose of being paid money. However, all activities that are economic in nature that one engages in have associated health problems. This is because all machines and tools that workers interact with in the process of carrying out a production have attached hazards. In workplaces such occupational risks as noise, noise, vibration carcinogenic agents, ergonomic hazards and carbon particles have in most time resulted into asthma, back pain, hearing loss, obstructive pulmonary diseases, cancer, injuries, stress, and leukaemia. Many workers die in their active working age as a result of communicable and non-communicable diseases. Overwhelmingly, health problems cause economic loss to industrial establishments.

It is of note that many industrial workers do not have any insurance to compensate them in case of occupation diseases and injuries. It is quite imperative that effective industrial health services should be put in place to prevent the diseases and disorders as a result of industrial health problems.

2.0 OBJECTIVES

By the end of this unit, you should be able to:

- State occupational health problem in construction.
- describe occupational health problems associated with health institution.
- mention health problems associated with agriculture.

3.0 MAIN CONTENT

Construction industry is a manufacturing setting in which such activities as building maintaining and repairing structure take place. Construction workers are engaged in the construction of houses industrial building, and farms. They are also involved in the construction of roads, railways and bridges. Those individuals engaged in electrical work, painting and plumbing can also be said to be construction workers. The construction work is characterised by frequent change of work environment also different types of works take place at worksite by all types of people using hazardous materials at the same time. This perhaps contribute to increased exposure to hazardous substance which often led to poor health of construction workers.

OSHWIKI (2017) mentioned main health problems in the construction industry to include:

1. **Musculoskeletal disorder**: The construction industry has one of the highest rates of musculoskeletal disorder. The workers who suffer from musculoskeletal disorder have a reduced ability to perform tasks and in the most serious cases they could even become permanently disabled.
2. **Hearing Loss:** In construction industry, workers encounter noise of significant level. Exposure to high levels or long duration of noise is known to cause permanent hearing loss.
3. **Vibration:** Workers in Construction industry are constantly exposed to vibration in the process of work at worksites. Hand-arm vibration diseases normally result from the use of powered hand-tools, which could damage the nerves and blood vessels in the hand and arm. Also whole body vibration as a result of the use of heavy machinery and vehicles.
4. **Skin diseases:** Skin diseases are common among construction workers due to frequent handling and touching dangerous substances. Skin diseases may render the skin swollen, cracked, scaly and thickened.
5. **Respiratory diseases:** In construction industries workers are often exposed to hazardous substances like vapours and fumes.

The exposure may result into such diseases as silicosis, asbestosis and cancer.

6. **Psychosocial Health problems:** Stress, fatigue and burnout are often experienced by construction workers which usually lead to disorders.

3.2 Occupational Health Problems among Health Care Workers in Health Institutions

Health problem is health situation of a person that is harmful and causing worry. Health problems are generally caused in an individual by heredity, lifestyle practices and essentially exposure to toxic material in an industrial setting. Health care workers are those people whose duty is to look after the health of a person. Essentially the health care workers work to improve the health of an individual through accurate diagnose, treatment, prevention of diseases, injury and mental disorder. According to WHO, the international classification of Health care Workers include generalized medical practitioners, specialists medical practitioners, nursing professionals, midwifery professionals, traditional and complementary medicine professionals, paramedical practitioners, dentists, pharmacists, environmental and occupational health and hygiene professionals, physiotherapists, dieticians and nutritionists, audiologist and speech therapists, optometrists and ophthalmic opticians, medical and pathology laboratory technicians, paramedical technicians and assistants, medical and dental prosthetic technicians and their assistant or aids (Mohanty, Kabi and Mohanty, 2019). Health institutions are government and privately owned Primary Health Care Centres, clinics and hospitals.

Health care workers are at risk of contacting disease from the health institution environment. In health institution setting, health care workers can be infected with diseases that are generated in the institution through pollution as a result of improper disposal of waste and contact with machinery e.g. COVID-19.

Health workers can be infected through contact with patient and their relatives in the process of carrying out their duties. Such diseases include hepatitis B, malaria parasites and HIV/AIDS.

Health workers can suffer injuries as a result of the use of such instrument as razor blade, scissors and needles. In addition, they can suffer infection if the instrument is already infected.

Health workers are at the risk of exposure to ionizing radiation from x-ray machine and fluoroscopes used for diagnostic and therapeutic procedure. In this way they can have cancer.

Health care workers can suffer psychosomatic health problem as a result of burnout. Health problems such as migraine headache, stress, pain, depression experienced as a result of burnout brought about by work overload, mental exhaustion, poor remuneration, unfulfilled promises and underachievement.

Health care workers are at the risk of violent attack by patients and patients' relative. According to Mohanty, Kabi and Mohanty (2019) Workplace violence is one of the most complex and dangerous hazards faced by resident doctors, nurses and helpers.

3.3 Occupational Health Problems in Institutions of learning

Educational institution is a place where teaching and learning take place for people of different ages to gain knowledge, attitude and good practice. In educational institution, there are students, teaching and non-teaching staff as well as proprietors. Pre-school, childcare, primary, secondary and tertiary institutions are all regarded as educational institutions.

It is important that proprietors of educational institutions ensure health promoting environment for meaningful teaching and learning to take place: In educational institution infection is a prominent health problem. This is because teachers interact extensively with learners and materials during the process of carrying out their duties. Transmission could occur from already infected learners or from contaminated materials prepared as teaching aids and for practical demonstration in laboratory. Such diseases include tuberculosis, cough, measles and COVID-19.

1. **Contact dermatitis:** It is a health problem among teachers. This is as a result of the fact that the material used in the production of chalk commonly used to write on the chalkboard is an agent causing contact dermatitis.
2. **Voice disorder:** Voice disorder is characterised by a person's inability to speak normally. This is as a result of laryngitis or damaged vocal cords. It may cause the voice to be hoarse or sound strained. The major cause of the dysfunction is excessive use of voice such as making load sound. It is a known fact that teachers speak for long hours while teaching. Teachers at time have to speak at the topic of their voices especially when teaching large classes. In this way teachers are prone to voice dysfunction.
3. **Musculoskeletal disorder:** The disorder may take the form of leg pain, low back pain, arm pain and shoulder. This may be as a result of poor body carriage and sedentary lifestyle.
4. **Job burnout:** Burnout is when physical, emotional and mental components of a person experience exhaustion. This can be

caused by stress one of the job burnout one experiences is stress as a result of work overload. Teacher do experience burnout due to work overload. Teachers attend to large number of learners especially in elementary classes. Some are troublesome and will always attract the attention of teachers. Poor working environment as well as inadequate remuneration including personal problem all contribute to burnout experienced by teachers.

5. **Anxiety disorder:** It is characterised by a strong feeling of worry. The health problems as a result of anxiety include high blood pressure, chest pain, rapid change and palpitation. Anxiety disorder can be caused in educational institution by outbreak of disease and insecurity. The fear of learners being killed by COVID-19 and the activities of kidnappers whose target is now learners in educational institution are enough to cause anxiety to teachers and head teachers including proprietors.

3.4 Occupational Health Problems Associated with Agriculture

In the broadest sense, agriculture is made up of such activities as crop production, livestock keeping, forestry and fishing. The activities in crop production are clearing the ground, planting, weeding and harvesting. Livestock keeping involve the management and breeding of domestic animals. Forestry involves planting, tending, managing and utilization of forest products. Fishing is the activity of trying to catch fish. It is of note that persons involve in all the activities of agriculture encounter associated health problems.

Workers engaged in crop production activities can experience such health problems as byssinosis as a result of inhaling hemp and cotton particles, dermatis resulting from wood dust, skin disease as a result of been allergic to certain plants and chemicals e.g. allergic conjunctivis from rubber. Musculoskeletal pains which refers to pain in the muscles, bones, ligaments, tendons, and nerves as a result of bad posture, frequent bending down to work and or long standing.

Forestry workers encounter such health problems as bronchitis, lumbar pain. In addition, forest workers are at the risk of falling branches, chain saw accident and fall which may occur as a result of on slippery area. Musculoskeletal pain as a result of lifting, pushing, pulling, holding, reaching for or carry objects.

Fishermen suffer injury due to cutting or piecing objects or fall. They are also at the risk of drowning if the boat hit rock and or capsize. Lead

poisoning is also possible among those who made their own lead sinkers.
Agricultural worker can be involved in accident which can lead to injuries and result in all kinds of wounds such as abrasion, laceration and cuts.

SELF-ASSESSMENT EXERCISE

List the health problems among health care workers in health institutions.

4.0 CONCLUSION

Hazard inevitably exist in industrial settings. Exposure to hazard if not prevented can lead to such health problems as injury, disease and disorder. Occupational health problems affect negatively the health and wellbeing of workers which in turn lead to reduction in productivity and eventually constitute economic loss to industry.

5.0 SUMMARY

In this unit we have learnt that occupational health problem such as injury, disease and disorder are encountered in industrial settings.

Industrial health hazards such as noise, vibration, carcinogenic agents and ergonomic hazards result into such health problems as asthma, back pain, hearing loss, obstructive pulmonary disease, cancer wounds and stress.
In construction industry, health problems encountered are musculoskeletal disorder and hearing loss, skin diseases, respiratory disease and psychosocial health problems such as stress, and fatigue.

Health problems of health care workers are hepatitis B, malaria parasites and wounds. The health workers can suffer migraine headache, stress, pain and depression.

In institution of learning, teachers can suffer cough, and measles. Teachers can have such health problems as contact dermatitis, voice disorder, musculoskeletal disorder and anxiety disorder.

Health problems of agricultural workers are byssinosis, skin disease as a result of been allergic to certain plants and chemical. They also suffer musculoskeletal pain.

6.0 TUTOR-MARKED ASSIGNMENT

1. Describe occupational health problem
2. What are health problems in educational institutions?

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UNIT 4 HEALTH PROBLEMS OF OFFICE WORKERS

CONTENTS

1.0 INTRODUCTION

Employees do work assiduously to play his/her own part in helping the establishment to achieve its goal. Therefore, the worker directs all his/her energies to the activities of making a meaningful contribution. In this way heavy physical and mental demands are encountered everyday which might exert harmful effect on the general wellbeing of the worker.

Activities engaged in that occupy one's time with the intention of monetary gain could be termed occupation. However, it should be realized that all economic activities have associated health hazards. Essentially, exposure to hazard result into health problems. In the same vein activities that take place in offices have the health hazard and when the exposure is not prevented, it can snowball into health problems.

Office workers are engaged in such activities of preparing and processing document, making preparation for meeting, arranging for appointment, monitoring income and expenditure. Infact office work requires full concentration, long sitting and quick decision making. Office workers are subjected to heavy occupational burden due to a variety of job functions. Therefore, in the course of their work, they encounter physical and health problems. Meanwhile, health problems constitute setback to increased productivity in an industry. This is because a worker suffering from one health problem or the order remain unfit to give best services. It is therefore, important that the management of industry put in place proper measures to rid of the industry of health problem.

2.0 OBJECTIVES

By the end of this unit, you should be able to:

- Describe office workers and their duties
- State office workers' health problems

3.0 MAIN CONTENT

3.1 Description of Office workers and their duties

Literarily a person who stays in the office all through to perform his/her duties can be said to be office worker. They do administrative and clerical duties. Essentially their activities are tailored toward supporting the daily operations in an establishment.

According to Zippa (2020) office worker should possess such skills and personal traits as:

(i) **Customer-service skill**: Customer service skill can be put into use in providing general information to company staff, customers, or the public and organizing data entry information into corporate database and processed products to be distributed to customers.

(ii) **Detailed Oriented skill**: this skill is important in performing many clerical tasks that require attention to detail, such as preparing bill, money handling, paying bills, scheduling appointment and answering calls.

(iii) **Organisational skill**: This skill is important in performing various tasks concerning filing and organization of important documents, data entry and organization duties.

(iv) **Communication skill**: this skill is necessary for the individual to be able to speak clearly and fluently and understand what is being spoken. This is because communication is all about message delivery and response for immediate action.

Duties of administrative officer includes preparing and processing document, arranging meetings and appointment, monitoring the budge and expenditures, handling inventory and procurement of the office supplies, and developing strategies to optimize office operation; they also address issues and concerns resolving them promptly and professionally. They co-ordinate staff and implement the company's policies and regulations; while the duties of assistant administrative staff include answering phone calls, providing the public and customers with information, and warmly welcoming, greeting, and directing visitors or guests accordingly issuing visitor badges, monitoring log books and

following procedures; they are responsible for preparing and processing travel vouchers and other documents (Zippa, 2020).

3.2 Office Workers' Health Problems

In offices, workers experience health problem that stem from exposure to hazards. Workplace health problems continues to increase, affecting negatively the product of industries in terms of quantity and quality. Barman (2020) and Pacific Prime (2018) identified office workers' health problems to include:

1. **Eye Strain**: Eye strain is accompanied with dry eyes and a painful sensation. It occurs as a result of staring into the computer screen for a long time. Also, having to look at spread sheets for hours can cause eye strain. The health problem can be avoided by having proper lighting at the worker's desk and adjusting the brightness of the computer screen. Also, the individual can rest eyes frequently by looking away from computer screen.
2. **Back pain**: It is a disorder brought about as a result of bad posture sitting for long hours can cause the problem. setting on poorly constructed chair can also cause back pain. Good chair should be provided. Also workers must participate in physical exercise.
3. **Headache**: It is caused by stress as a result of working in a competitive environment. In order to avoid headache, workers must take regular break between work.
4. **Cardiac arrests**: Cardiac arrest can be as a result of a heart attack, electrocution or a asphyxiation. In order to put this disorder in control office workers must keep an Automated External Defibrillator (AED) at all times in the office. An AED is a medical accessory to check heart rhythm and deliver an electric shock when necessary to restore the heart rhythm to normal.
5. **Obesity**: Obesity is caused by sedentary lifestyle, increased level of stress and eating of junk food found common among office workers. Meanwhile obesity is a main factor in increased levels of Low-Density. Lipoprotein (LDL) cholesterol often called bad cholesterol because it collects in the walls of blood vessels. It raises the chance of health problem like a heart attack or stroke. Obesity can have effects on muscles and posture resulting in a downward spiral of a healthy mind and body.

SELF-ASSESSMENT EXERCISE

Mention health problems of office workers

4.0 CONCLUSION

Health problem is a source of worry to the management in an industry. This is because a worker who is suffering from a disease is already incapacitated and cannot function to render services effectively. Reduced production of goods and service both in quality and quantity remain loss to the industry. It is important that exposure to hazards which could lead to health problem should be realistically prevented. The management of an industry must make available personal protective equipment to workers. Also, workers must as a matter of duty utilize the available devices. Chairs must be made to promote the health of workers. Also, proper lighting at the desk of worker must be ensured. Workers must adopt a health promoting lifestyle.

5.0 SUMMARY

In this unit we have learnt the following:

- Office workers perform administrative and clerical duties in order to support the day-to-day operations of an industry.
- Skills and personal traits needed by office workers to function effective include customer-service skills, detailed oriented skill, organizational skill and communication skill.
- Administrative officer must develop strategies to optimize office operation and address issues of concern. He/she also sees to the implementation industry's policies. The assistant administrative staff provides public and customers with information.
- Health problems of office workers are eye strain, back pain, headache cardiac arrest and obesity.

6.0 TUTOR-MARKED ASSIGNMENT

1. Describe administrative officers and their duties.
2. What are the skills and personal traits of office workers?

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UNIT 5 CARPAL TUNNEL SYNDROME AND COMPUTER VISION SYNDROME

CONTENTS

1.0 INTRODUCTION

Industrial workers encounter health problems in the course of doing their job. The health problem emanates from their interaction generally with the industrial environment and particularly with the tools and machines they use to do their work. Health problems in most time affect a particular part of the body rendering the part ineffective. Obviously, the ineffectiveness of the body will affect his/her productivity. A syndrome is a group of signs and syndrome which are interrelated with each other and are associated with a particular disease or disorder. Carpal Tunnel Syndrome and Computer Vision Syndrome are common disorders of industrial workers.

2.0 OBJECTIVE

By the end of this unit, you should be able to:

- State the causes and prevention of Carpal Tunnel Syndrome.
- Mention the causes and preventive measures against Computer Vision Syndrome.

3.0 MAIN CONTENT

3.1 Carpal Tunnel Syndrome

(1) Description of Carpal Tunnel Syndrome including its Causes

The carpal tunnel is a narrow passage located on the anterior portion of the wrist. According to Rodner, Raissis and Akelman (2009) as reviewed by American Academy of Orthopaedic Surgeons (2016), the carpal tunnel is a narrow passageway in the wrist, the floor and side of

the tunnel are formed by small wrist bones called carpal bone. Essentially, carpal tunnel protects the median nerve and flexor tendons that bend the fingers and thumb. Median nerves originate as a group of nerve roots in the neck; these roots come together to form a single nerve in the arm; the median nerve goes down the arm and forearm, passes through the carpal tunnel at the wrist, and goes into the hands; the nerve provides feeling in the thumb and index, middle, and ring fingers; the nerve also controls the muscles around the base of the thumb (AAOS, 2016). According to American Academy of Orthopaedic Surgeons (2016). The carpal tunnel syndrome occurs when the tunnel becomes narrowed or when tissues surrounding the flexor tendons swell putting pressure on the median nerve. These tissues called synovium lubricates the tendons making it easier to move finger.; when the synovium swells, it takes up space in the carpal tunnel and overtime, crowds the nerve. This abnormal pressure on the nerve can result in pain, numbness, tingling and weakness in the hand.

The signs and symptoms of carpal tunnel Syndrome include:

- Frequent numbness or tingling in the finger with thumb, index and middle finger mostly affected.
- Pain in the hand and wrist.
- Weakness in the hand and arm.
- A shock-like sensations that spread to the thumb index and middle fingers.
- Clumsiness in the hand making it difficult to execute fine finger movements.

Causes of Carpal Tunnel Syndrome:

Essentially, Carpal Tunnel Syndrome is caused by increase in pressure on median and tendons in the carpal tunnel. Also, trauma that lead to sprain or fracture causing wrist to swell.

Risk factors of Carpal Tunnel Syndrome

Experts such as NIH 2020, Mayo Clinic, 2020, and AAOS, 2016 identified risk factors of Carpal Tunnel Syndrome to include the following:

1. **Genetic make-up:** As a result of heredity, a carpal tunnel may be smaller which leads to reduction in the amount of space for the nerve. Altered space within the carpal tunnel put pressure on the median nerve leading to carpal tunnel syndrome.
2. **Repetitive hand use:** Repeating the same hand and wrist motions or activities over a prolonged period of time may

exacerbate the tendons in the wrist, causing swelling that put pressure on the nerve.

3. **Accident:** Injury as a result of accident can cause fracture or dislocation which is capable of altering the space within the carpal tunnel making it narrow thereby putting pressure on the median nerve. Smaller carpal tunnels have been shown to cause carpal tunnel syndrome.
4. **Disease condition:** Some chronic diseases such as diabetes increase risk of median nerve damage. Also, rheumatoid arthritis can affect the lining around the tendons in the wrist and put pressure on median nerve.
5. **Pregnancy and menopause:** Fluid retention may increase the pressure within carpal tunnel thereby irritating the median nerve. This is common during pregnancy and menopause.
6. **Occupational factor:** Working with vibrating tools or on a assembly line that requires prolonged or repetitive flexing of the wrist may create damaging pressure on the median nerve or worsen existing nerve damage, especially if the work is done in a cold environment. Also, frequent computer use can cause carpal tunnel syndrome. The mouse use and the use of a keyboard have been identified as the cause of the problem. Carpal tunnel syndrome may be reported in workers performing assembly line work such as manufacturing, sewing, fishing, cleaning and meatpacking.

Prevention of Tunnel Syndrome

1. **Good posture:** Workers should avoid poor body carriage because incorrect posture rolls shoulders forward, shortening neck and shoulder muscles compressing nerves in the neck thereby affecting wrists, fingers and nails which can cause neck pain.
2. **Regular physical exercise:** At workplace workers can take some time to do stretching exercises. They can bend hands and wrist periodically.
3. **Maintaining good sitting position:** Avoid bending wrist all the way up or down. A relaxed middle sitting position is the best.
4. **Correct placing of computer mouse:** Computer mouse shoulder be placed comfortably so that its use does not strain wrist.
5. **Keep hand warm:** Ensure the wearing of fingerless gloves that can help keep hands warm and flexible.
6. **Improved industrial tools design:** Work stations, tools and tool handles can be redesigned to enable the worker's wrist to maintain a natural position during job performance.

Computer Vision Syndrome

Computer vision syndrome otherwise named digital eye strain can be described as a group of symptoms that can arise from eye and vision related problems arising from prolonged use of computer, tablet, e-reader and cell phone use.
Vision related problems can be as a result of the fact that such devices as computer tablet and smartphone put increase pressure on the eyes due to their prolong use.

Symptom of computer visions syndrome include headaches, eyes strain, eye irritation and blurred vision.

Factors contributing to occurrence of computer visions syndrome include:

(i) **Poor body carriage while sitting:** Poor placement of the body while sitting most especially due to faulty chair can make someone uncomfortable while viewing computer.
(ii) **Poor lighting**: The eyes work harder to view computer when the light is in short supply.
(iii) **Glare on a digital screen**: The eyes continue to struggle to see if there is a glare. A glare is sun or electric light shine with strong light.
(iv) **Improper viewing position**. This is positioning the screen at an angles that causes eye strain.
(v) **Prolong time staring at a computer screen.** This, again can cause eye-related health problem.

Prevention of Computer Visions Syndrome

Computer visions syndrome can be prevented if certain measures are taken. According to American Optometric Association (2020) some important factors in preventing or reducing the symptoms of Computer Vision Syndrome have to do with the computer and how it is used. This includes light conditions, chair comfort, location of reference materials, the position of the monitor and the use of rest breaks.

(i) **Location of the computer screen:** The computer be placed 15 to 20 degrees below eye level.
(ii) **Placement of reference materials:** Reference material should be placed above the keyboard and below the monitor. It is good to position the document well so that the head does not need to be repositioned from the document to the screen.
(iii) **Lighting:** Position the computer screen to avoid glare, particularly from overhead lighting or windows.

(iv) **Anti-glare screens:** In the event that there is no way to prevent glare from light sources, consideration should be given to the use of a screen glare filter. These filters decrease the amount of light reflected from the screen,

(v) **Seating position:** Chair should be comfortably padded and conform to the body. Chair height should be adjusted so that the feet can rest flat on the floor. Arm should be adjusted to provide support while typing and wrist should not rest on the keyboard when typing.

(vi) **Rest break:** In order to prevent eye strain, try to rest eyes when using the computer for long periods. Rest the eyes for 15 minutes after two hours of continuous computer use. Also, for 20 seconds to allow the eyes a chance to refocus.

(vii) **Blinking:** To Minimize the chances of developing dry eye when using a computer, try to blink frequently. Blinking keeps the front surface of the eye moist.

SELF-ASSESSMENT EXERCISE

- Describe Computer Vision Syndrome.
- What the preventive measure against Computer Vision Syndrome?

4.0 CONCLUSION

The use of computer has become inevitable in performing certain task. However, computer has its health hazards which lead to health problem. Health problem can be prevented if certain precautions are taken when using computer.

5.0 SUMMARY

- In this unit we have learnt that computer vision syndrome describes a group of symptoms that results from an individual spending long staring at computer screen. The individual experiences eye strain, dry and itchy eyes, headaches, backache and blurry vision.
- Risk factors of Computer Vision Syndrome include poor body carriage, poor lighting, improper view position and glare on the digital screen.
- Computer Vision Syndrome can be prevented by paying particular attention to what a worker does with computer and how it is used.

6.0 TUTOR-MARKED ASSIGNMENT

1. What are the risk factors of carpal tunnel syndrome?
2. How can Carpal Tunnel Syndrome be prevented?

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MODULE 5 PREVENTION OF INDUSTRIAL HEALTH PROBLEMS

Unit 1 Methods of Preventing Industrial Diseases and Disorders
Unit 2 Roles of Government and International Organisations in Industrial Health

UNIT 1 METHODS OF PREVENTING INDUSTRIAL DISEASES AND DISORDERS

CONTENTS

1.0 INTRODUCTION

It is important to prevent and control the identified health problems in the previous units in order to achieve the goal of industrial, health. The unit examines the strategies put forward by experts for the prevention and control of industrial diseases, disorders and injuries.

2.0 OBJECTIVES

By the end of this unit, you should be able to:

- Explain the strategies of prevention and control of industrial diseases, disorders and injuries.
- Discuss the role of health education in the prevention of industrial diseases.

3.0 MAIN CONTENTS

3.1 Prevention and Control of Industrial Diseases and Disorders

Prevention is cost effective compared to treatment. Prevention is action or measures taken to stop the occurrence of a disease. Control of a disease implies measures that are taken to prevent transmission after a disease has occurred. Basically, prevention of industrial disease is used to mean elimination of incidence and long or short duration of disease together with loss of resources as a result of the occurrence.

Disease and injury prevention in industrial setting can only be achieved through the collective effort of the industrial workers, management and government. On the path of workers, it is important for them to have a good knowledge of hazards associated with their job and abstain from risky health behaviour like smoking, abuse of drug, sedentary lifestyle negligence of safety rules. Managers of industries should ensure that psychological and physical needs of industrial workers are met, also protective device are provided. Government should make available infrastructural facilities including effective health service. Essentially hygienic environment of industries is of paramount importance to the prevention and control of industrial diseases and injuries.

Hierarchy of Industrial Hazard Prevention and Control Strategies
Prevention and Control: Strategies for industrial hazards prevention and control identified by experts include the following:

1. Elimination
2. Substitution
4. Engineering control
5. Administrative control
6. Use of Personal Protective Device
7. Industrial Health education

3.2.1 Elimination

Elimination in the context of industrial health is disruption of the cycle of the spread of a disease or proliferation of a particular health problem. Elimination of disease is the deliberate effort made at reducing to zero the incidence of a disease in defined area. Effective use of substitution strategy carries with it some responsibilities. Hazardous chemical must be identified. Identification of less hazardous material as well as a good knowledge of the use of new products to be used is also important.

3.2.2 Substitution

Substitution is the act of removing hazardous products or process and replacing it with less hazardous but effective products or process. The use of carborundum grinding wheel instead of sandstorm has paid off in solving the problem of silicosis. Also, the use of diesel rather than coal to power a locomotive engine is better because diesel produces less smoke and external heat than coal.

3.2.3 Engineering Control

Engineering control remove or reduce a hazard, or they place a barrier between the worker and the hazard. Examples include the use of detergent plus water cleaning solutions instead of organic solvent, use of leadless glazes in the ceramics industry. Engineering control could involve changing a piece of machinery or work process to reduce exposure to a hazard. Also working a limited number of hours in hazardous section of workplace. Some other types of engineering control include enclosure, isolation and ventilation.

(i) **Enclosure** – This is the act of allowing highly toxic materials that are released in the air in the process of work to take place in an enclosed area. Machine guarding is another form of enclosure that can prevent workers from coming in contact with hazardous part of machine.

(ii) **Isolation** – This is a method of hazard control that involves hazardous material been moved to a part of workplace to where fewer people will be exposed or job been changed to a shift when fewer people will suffer exposure.

(iii) **Ventilation** – Ventilation in work place is used to prevent work environment from getting too hot, cold, dry or humid. It is used to prevent contaminants in the air from getting into the area where workers breath.

Two categories of ventilation are identified viz: general or dilution ventilation and local exhaust ventilation.

(a) **General or dilution ventilation:** It adds or removes air from workplace in order to keep the concentrations of an air contaminants at a level it can no longer be hazardous.

(b) **Local exhaust ventilation:** It is regarded as classical method of control for dust fumes, vapours and other air-borne toxic or gaseous pollutants. Local exhaust ventilation system captures the contaminants at their source before they escape into the work room area.

3.2.4 Administrative Control

Administrative control can be regarded as training procedure, policy or shift designs aimed at reducing exposure of workers to hazardous materials on a particular workplace. Administrative control example includes changing work schedule to prevent long hours of exposure to hazardous chemical, giving workers longer rest periods or shorter work shift in order to reduce exposure time and changing a work schedule to a shift when fewer people are working and ensuring that workers are appropriately remunerated. A good example of administrative control together with engineering controls and personal protective equipment is: a five-hour limit for work in a fully enclosed high-noise area where ear protector is required.

3.2.5 Use of Personal Protective Devices

Personal protective devices are the equipment that protect workers against health hazards associated with one's job. Personal protective devices include the following:

1. **Head Protection Equipment**
   Head is a delicate part of the body and should be well protected. Therefore, steel or plastic safety helmet should be worn at workplaces where workers are prone. Safety cap or hat protect the worker in construction from high impact forces or falling objects. Head protection device should be used by construction workers, supervisor as well as visitor at construction site. This is because of sharp or heavy material falling from various heights.
2. **Respiratory Protective Equipment**
   The device is purposely designed to be worn by workers who are at the risk of exposure to such hazardous material as dust, fumes and mist. The equipment should be well selected and worn appropriately. However, before the use of respiratory protective equipment attempt must first be made to eliminate the associated hazards. In the selection of equipment, consideration must be given to physical and as well as chemical nature of the contaminants.
3. **Eye and face Protection Equipment**
   Safety glasses or perhaps shields can be worn to protect the eyes from small particles that can penetrate into the eyes and cause damage. Eye protection can also include spectacles, goggles and handled screens.

   Workers who are at the risk of exposure to acids, flying particles, light radiation, molten metal should always use the devices. Also, provision should be made for emergency eye washing facilities

especially where workers are frequently exposed to corrosive metals.

4. **Foot Protection Equipment**
   The use of foot protection equipment is important for industrial workers most especially those working in construction sites and in the farms. Provision of shoes or boots with puncture protection is necessary most especially where broken bottles, nails, wire, screws, staple can be stepped on by the workers resulting in foot injury. Boot to be worn should be carefully selected taking into consideration the size of the wearer and nature of hazard.
6. **Protective Clothing**
   It is a clothing specially made and treated for the purpose of protecting wearer from exposure to dangerous work situations. Protective clothing can be overalls. Protective clothings can also protect users from wear and tear and dirt. It can protect the worker from chemicals that can come in contact with the skin causing a damage to the skin.

3.2.6 Industrial Health Education

Health education is an instrument that modifies lifestyle and behaviour through its enduring health knowledge provision and attitude change mechanism. The achievement of objective of industrial health which is health and safety is a function of knowledge and favorable disposition of workers to the practice of safety. Health education is a potent strategy that can be used to prevent industrial health problem.

Health education has three components as identified by experts: Health instruction, health service and health promoting environment.

1. **Health Instruction**
   This is an organized teaching of relevant topics for the purpose of provision of health knowledge for attitude change in order to bring about desirable health practice among workers. In order to achieve this, various approaches and methods as well material resources are used and in the final analysis the instructional programme is evaluated.
2. **Health Service**
   It includes preventive and curative services rendered to ensure that the present health status of workers guarantee optimum performance. Personnel involved are physician, health educators and social workers. Specific services rendered are:

- Pre-employment medical examination
- Periodic medical examination
- Health counselling of worker

- Provision of first aid treatment in cases of injury and sudden illness
- Prevention and treatment of disease
- Sanitation of industrial establishment environment

3. **Health Promoting industrial environment**
   The industrial environment that promotes physical, social and emotional health is the one that can guarantee health and safety of workers. Specific industrial environment indices that will promote the health of workers include:

(i) Industrial environment that has a safe water supply, sewage and waste disposal, lighting and ventilation.
(ii) Firefighting facilities
(iii) Effective workers' welfare programme

SELF-ASSESSMENT EXERCISE

What are the strategies that can be used to prevent and control industrial disease?

4.0 CONCLUSION

The need to ensure safety and health of workers in the workplace has made it imperative to prevent and control the industrial health problems identified in the previous module. Strategies for prevention and control of disease, injuries and disorders put forward by experts can be a panacea for solving the entire industrial health problems.

5.0 SUMMARY

In this unit effort was made to identify the following:

- Disorders, injuries and diseases suffered by workers as result of the industrial health hazard in industrial setting.
- Strategies for prevention and control of industrial health problems as identified by experts are elimination, substitution, engineering controls, administrative controls, use of personal protective device and industrial health education.

6.0 TUTOR MARKED ASSIGNMENT

1. Explicate the terms:
   (i) Prevention and (ii) Control
2. State the three components of industrial health education.

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UNIT 2 ROLES OF GOVERNMENT AND INTERNATIONAL ORGANISATIONS IN INDUSTRIAL HEALTH

CONTENTS

1.0 INTRODUCTION

Quality goods and services produced in industries can boost the economy of a country and makes for national development. It should however be noted that only healthy industrial workers can work to produce goods and service. This is why the state of health of workers is of concern to government. Industrialization has brought with it such problems as diseases, pollution, accident, increased social vices, overstretched health facilities to the community. Increased cases of illness and injuries are being recorded among workers as a result of industrial hazards. Poor sanitation characterized some industries. Some industrialists are concerned mostly about monetary gain and neglect workers' welfare. Occupational safety and health laws and enforcement bodies are apt to the protection of health and safety of industrial workers. The International organisations also have crucial role to play in the occupational health and safety of workers. This unit discusses the constitutional provisions for occupational health and safety, occupational safety and health law enforcement bodies as well as roles of government, labour unions and international organizations in health and safety of industrial workers.

2.0 OBJECTIVES

By the end of this unit, you should be able to:

- State the main laws on occupational safety and health in Nigeria
- Mention and discuss two occupational safety and health law enforcement bodies.

- Roles of International organization in promoting health and safety of industrial workers.

3.0 MAIN CONTENT

3.1 Constitutional Provisions for Occupational Health and Safety

The concern of government for the wellbeing of industrial worker has been demonstrated by giving legal backing to health and safety in industries in Nigeria. The constitutional provisions for occupational health and safety in industries as contained in "The Factories Act CAP F1, Laws of the Federation of Nigeria (L.P.N.) 2004" are as follows:

Health (General Provisions)

Cleanliness

(1) Every factory shall be kept in a clean state, and free from effluvia arising from any drain, sanitary convenience or nuisance, and without prejudice to the generality of the forgoing provision -

(a) accumulation of dirt and refuse shall be removed daily by a suitable method from the floors and benches of workrooms, and from the staircases and passages;

(b) the floor of every workroom shall be cleaned at least once in every week by washing or, if it is effective and suitable, by sweeping or other method;

(c) all inside walls and partitions, and all ceilings or tops of rooms, and all walls, sides and tops of passages and staircases shall-

(i) where they have a smooth impervious surface, at least once in every period of twelve months be washed with hot water and soap or cleaned by other suitable method;

(ii) where they are kept painted with oil paint or vanished, be repainted or varnished at least once in every period of five years, and at least once in every period of twelve months be washed with hot water and soap or cleaned by other suitable method.

(iii) in the other cases, be kept whitewashed or colour-washed, and the whitewashing or colour-washing shall be repeated at least once in every period of twelve months.

Overcrowding

(1) A factory shall not, while work is carried on therein, be so overcrowded as to cause risk or injury to the health of the persons employed therein.

(2) Without prejudice to the generality of the foregoing provisions, a factory shall be deemed to be so overcrowded as aforesaid if the number of persons employed at a time in any workroom is such that the amount of cubic space allowed for every person employed is less than 400 cubic feet.

Ventilation

Effective and suitable provision shall be made for securing and maintaining by the circulation of fresh air in each workroom the adequate ventilation of the room.

Lighting

Effective provision shall be made for securing and maintaining sufficient and suitable lighting, whether natural or artificial, in every part of a factory in which persons are working or passing.

Drainage of Floors

Where any process is carried on which renders the floor liable to be wet to such an extent that the wet is capable of being removed by drainage, effective means shall be provided and maintained for draining of the wet.

Sanitary Conveniences

Sufficient and suitable sanitary conveniences for the persons employed in the factory shall be provided, maintained and kept clean, and effective provision shall be made for lighting the conveniences and, where persons of both sexes are or are intended to be employed (except in the case of factories where the only person employed are members of the same family dwelling there), such conveniences shall afford proper separate accommodation for persons of each sex.

Safety (General Provisions)

Prime Movers

(1) Every flywheel directly connected to any prime mover and every moving part of any prime mover, except any prime mover mentioned in subsection (3) of this section, shall be securely fenced, whether the flywheel or prime mover is situated in an engine-house or not.
(2) The head and tail race of every water wheel and of every water turbine shall be securely fenced.

(3) Every part of any electric generator, motor or rotary converter, and every fly-wheel directly connected thereto, shall be securely fenced unless it is in such a position or of such construction as to be safe to every person employed or working on the premises as it would be if securely fenced.

Transmission Machinery

Every part of any transmission machinery shall be securely fenced unless it is in such position or of such construction as to be as safe to every person employed or working on the premise as it would be if securely fenced.

Powered Machinery

(1) Every power-driven machine having its individual sources of power shall be provided with an efficient starting and stopping appliance or control.
(2) Every electrical equipment or appliance intended for use in a factory shall be of such construction as to be safe for use by all persons required to use same or who come into contact with same and shall be maintained at all times in a safe condition.

Other machinery

Every dangerous part of any machinery, other than prime movers and transmission machinery, shall be securely fenced unless it is in such a position or of such construction as to be as safe to every person employed or working on the premises as it would be if securely fenced, provided that, in so far as the safety of dangerous part of any machinery cannot by reason of the nature of the operation be secured by means of a fixed guard, the requirements of this subsection shall be deemed to have been complied with if a device is provided which in the opinion of the Director of Factories satisfactorily protects the operator or other persons from coming into contact with this part.

Provisions as to unfenced machinery

In determining, for the purposes of the forgoing provisions of this Part of this Act, whether any part of any machinery is in such a position or of such construction as to be as safe to every person employed or working on the premises as it would be if securely fenced.

no account shall be taken of any person carrying out, while the part of machinery is in motion, an examination thereof or any lubrication or

adjustment shown by such examination, lubrication or adjustment which it is necessary to carry out while the part of machinery is in motion.

Construction and disposal of new machinery

Every set-screw, bolt or key on any revolving shaft, spindle, wheel or pinion shall be so sunk, encased or otherwise effectively guarded as to prevent danger.

Vessels containing dangerous liquids

Every fixed vessel, structure, sump or pit of which the edge is level with or less than 91 centimeters above the adjoining ground or platform shall, if it contains any scalding, corrosive or poisonous liquid, either be securely covered or be securely fenced to at least that height or where by reason of the nature of the work neither secure covering nor secure fencing to that height is practicable, all practicable steps shall be taken by covering, fencing or other means to prevent any person from falling into the vessel, structure, sump or pit.

Self-acting machines

No traversing part of any self-acting machine and no material carried thereon shall, if the space over which it runs is a space over which any person is liable to pass, whether in the course of his employment or otherwise, be allowed on its outward or inward traverse to run within a distance of 46 centimeters from any fixed structure not being part of the machine.

Training and supervision of Inexperienced workers

No person shall be employed at any machine or in any process, being a machine or process liable to cause bodily injury, unless he/she has been fully instructed as to the dangers likely to arise in connection therewith and the precautions to be observed, and

(a) has received a sufficient training to work at the machine or in the process; or
(b) is under adequate supervision by a person who has a thorough knowledge and experience of the machine or process.

Hoists and Lifts

(1) Every hoist or lift shall be of good mechanical construction, sound material and adequate strength and be properly maintained.

(2) Every hoist or lift shall be thoroughly examined at least once in every period of six months by a person approved for the purpose of this section by the Director of Factories by a certificate in writing; and a report of the result of every such examination in the prescribed form and containing the prescribed particulars shall be signed by the person making the examination and shall within fourteen days be filed with the Director of Factories and also be entered in or attached to the general register.

Chains, ropes and lifting tackle

No chain, rope or lifting tackle shall be used unless it is of good construction, sound material, adequate strength and free from patent defect.

Cranes and other lifting machines

(1) All parts and working gear whether fixed or movable, including the anchorage and fixing appliances of every lifting machine, shall be of good construction, sound material, adequate strength and free from patent defect and shall be properly maintained.
(2) All rails on which a travelling crane moves and every track on which the carriage of a transporter or runaway moves shall be of proper size and adequate strength, and be properly laid, adequately supported or suspended, and properly maintained.
(3) In this section the expression, **"lifting machine"** means a crane, winch, , pulley block, gin wheel, transporter or runway.

Safe means of access and safe place of employment

(1) All floors, steps, stairs, passages, gangways and other parts of a structure or building used as a factory shall be of sound construction and properly maintained and kept safe at all times and before the construction of any factory, the building plans and such other documents as the Director of Factories may require, shall be submitted to him for approval not less than six months before the commencement of such construction.
(2) All openings in floors shall be securely fenced, except in so far as the nature of the work renders such fencing impracticable.

Precautions with respect to explosive or inflammable dust, gas, vapour or substance

Where in connection with any grinding, sieving or other process giving rise to dust, gas or vapour there may escape into any workroom dust, gas or vapour of such a character and to such an extent as to be liable to

explode on ignition, all practicable steps shall be taken to prevent such an explosion by enclosure of any plant used in the process, and by removal or prevention of accumulation of the dust, gas or vapour and by exclusion or effective enclosure of possible sources of ignition.

Steam Boilers

Every steam boiler and all its fittings and attachments shall be of good construction, sound material, adequate strength and free from patent defect and shall be properly maintained.

Steam receivers and steam containers

Every steam receiver and all its fittings shall be of good construction, sound material, adequate strength, and free from patent defect, and shall be properly maintained.

Air Receivers

Every air receiver shall –

(a) have marked upon it, so as to be plainly visible, the safe working pressure;
(b) in the case of a receiver connected with an air compressing plant, either be so constructed as to withstand with safety the maximum pressure which can be obtained in the compressor, or be fitted with a suitable reducing valve or other obtained in the compressor, or be fitted with a suitable reducing valve or other suitable appliance to prevent the safe working pressure of the receiver being exceeded.

Prevention

(1) In every factory there shall be correctly installed, in appropriate places, effective means for detecting fire, and such means shall be provided and maintained, so as to be readily accessible, in the case of a manual device, or alerting occupants therein of the occurrence of a fire and for extinguishing same, which means shall be adequate, suitable and approved by the Director of Factories having regard to the circumstances of each factory.
(2) All stocks of highly inflammable substances shall be kept either in a fire-resisting store or in a safe place outside any building; provided that no such store as aforesaid shall be so situated as to endanger the means of escape from the factory or from any part thereof in the event of a fire occurring in the store.

Safety Provisions in case of Fire

(1) Every factory shall be provided with adequate means of escape in case of fire for the persons employed therein, having regarded to the circumstances of each case.

Prevention of Fire

(1) In every factory there shall be correctly installed, in appropriate places, effective means for detecting fire, and such means shall be provided and maintained, so as to be readily accessible, in the case of a manual device, for alerting occupants therein of the occurrence of a fire and for extinguishing same, which means shall be adequate, suitable and approved by the Director of Factories having regard to the circumstances of each factory.

Safety Provisions in case of fire

(1) Every factory shall be provided with adequate means of escape in case of fire for the persons employed therein, having regard to the circumstances of each case.
(2) All such means of escape as aforesaid shall be properly maintained and kept free from obstruction.
(3) While any person is within a factory for the purpose of employment or meals, the doors of the factory, and of any room therein in which the person is and any doors which afford a means of exist for persons employed in the factory from any building or from any enclosure in which the factory is situated, shall not be locked or fastened in such manner that they cannot be easily and immediately opened from the inside.
(3) All doors affording a means of exits from a factory to the persons therein shall, except in the case of sliding door, open outwards.

Power of Inspector to issue prohibition notice as to dangerous factory

(1) If the inspector is satisfied that any factory or part of a factory is in such a condition or is to constructed or placed that any process or work carried on therein cannot be so carried on without undue risk to the safety and health of persons employed therein, the inspector shall by notice prohibit the use thereof for the purpose of that process or work.
(2) A notice issued by an inspector under this section may –
(a) prohibit the carrying on of any process or work whether indefinitely or until such steps as may be specified in the notice have been taken to enable the process or work concerned to be

carried on with due regard to the safety and health of persons employed therein; and

(b) be revoked on the application of the occupier or owner of the factory after rectifying all the defects in the notice to enable the process or work to be carried on with due regard to the safety and health of persons employed therein.

3.2 Occupational Health and Safety Law Enforcement Bodies

3.2.1 Occupational Safety and Health Department of the Federal Ministry of Labour and Employment

The Ministry has the mandate of safeguarding and promoting the safety, health and wellbeing of workers in their various workplaces with a view to preventing the occurrence of work-related illness, injuries and or death and the reduction of damage to property, thereby improving productivity (ILO, 2016).

Functions of Occupational Safety and Health Development pertaining to monitoring, compliance and enforcement of the National Occupational Safety and Health Policies and legislature are:

i. Inspection of workplace in relations to OSH;
ii. Registration of new factory premises, amendment and revocation of certificates of registration of existing registered factories;
iii. Collection of revenue for new registration, amendment and renewals of Certificates of Registration of factory and Certification of Competent Persons for lifting equipment and pressure vessels examination;
iv. Investigation of accidents, dangerous occurrences and cases of occupational diseases;
v. Conduct of medical examination and surveillance of workers' health;
vi. Occupational Hygiene and Laboratory Services;
vii. Enforcement by issuing improvement and prohibition notices and as the last resort to instituting legal proceedings.

Enforcement Pyramid

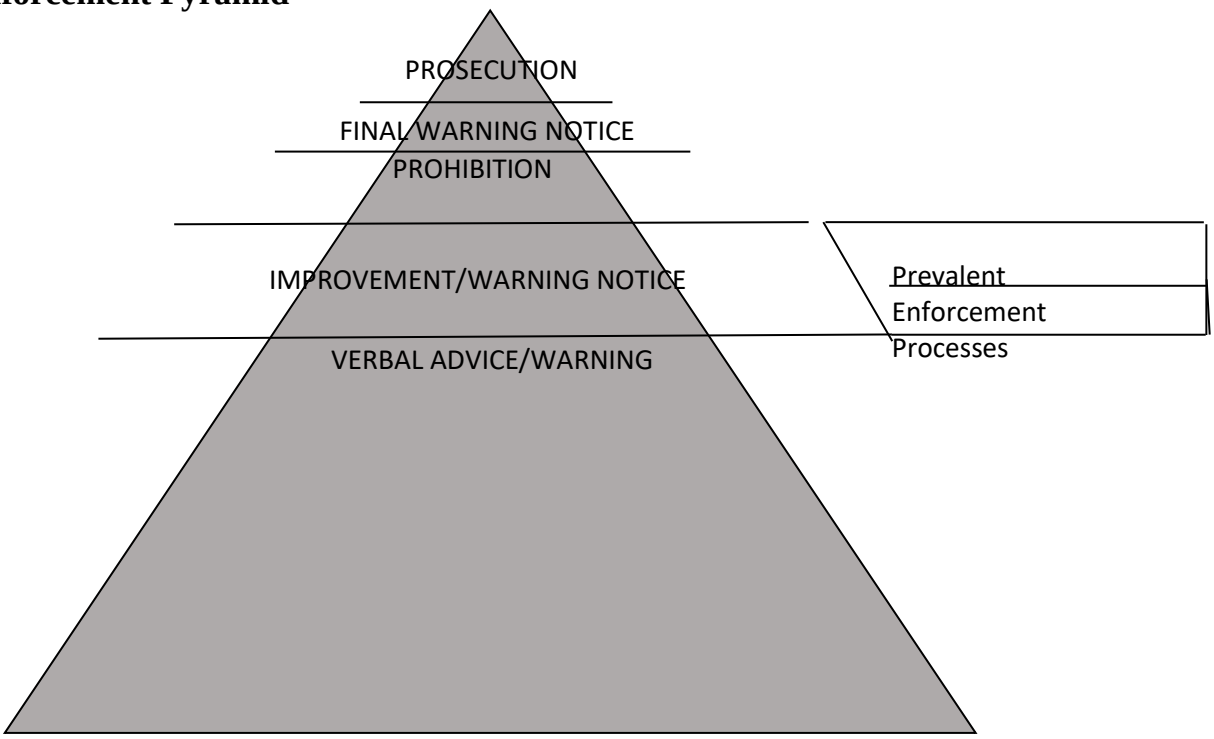

Figure 1: OSH Departmental enforcement processes
Source: *International Labour Organisation (2016). Nigeria country profile on Occupational Safety and Health*

2. **Nigeria Labour Congress (NLC)**

Nigeria Labour Congress (NLC) came into existence in 1978. Member of NLC comprise of workers in public and private establishment in Nigeria. NLC is an umbrella body for 43 unions. NLC as a labour Union was formed purposely to protect, defend and promote the right, well-being and the interests of all workers, pensioners and trade unions. NLC also serve to promote and defend a Nigerian nation that would be just, democratic, transparent and prosperous and to advance the cause of the working class generally.

The organs of the NLC are the National Administrative Councils, Central Working Committees, National Executive Council; and the National Delegates Conference. There are seven (7) departments in the congress namely – Administration; Education; Finance; Industrial Relations; Research; Women and Youth; and Health and Safety. The department of Health and Safety is saddled with the responsibility of implementing the congress occupational, safety and health activities.

3. **Trade Union Congress of Nigeria (TUC)**
   Trade Union Congress of Nigeria was registered as a labour centre. TUC is majorly concerned about securing equitable observance of all agreements reached between the TUC and employers of labour.

Aims and Objectives of TUC include:

a) To promote and safeguard the economic and social welfare of its members, preserving and extending their rights within a just, free and democratic society.
b) To promote and support legislation that are in the best interest of senior staff their associations.
c) To encourage the participation of members of commerce, industry, mines and agriculture at national and international levels, including the printing and publishing of the Congress' newsletters, journals and books of any other variety.
d) To render all possible contributions to the well-being of the government workers and other employees as would engender maximum productivity and economic sufficiency.
e) To establish and promote cultural co-operation and positive social activities.
f) To undertake the education and enlightenment of its members through seminars, symposia, workshops, and the use of bulletins and educational pamphlets with a view to promoting the interests of senior staff associations in Nigeria.

3.3 Roles of International Organisations in Industrial Health and Safety

Social economic and health problems confronting countries of the world seem to be intercontinental in nature. This is why it is imperative for scientists and professional groups all over the world to come together to brainstorm and come up with a common measure for solving identified problems. The need for interdependence of nations of the world cannot be overemphasised.

The realisation that there are problems which require that countries of the world should come together to find common solution led to the idea of International organisation. According to ILO Content Manager (2011) the major roles of international organisation are: (i) to offer an organised framework for international cooperation and to (ii)translate agreed-upon values into rights and obligations. He further stated that aims and purposes of international organisations are set out in their charters, constitution, statues or basic text; for example, the constitution of the World Health Organisation (WHO) (1978) states that its aim is

"The attainment by all people of the highest possible level of health. Protection of the workers against sickness, disease and injury arising from employment is one of the tasks assigned to the International Labour Organisation ILO as stated in preamble of its constitution ILO (1992) and reviewed by ILO Content Manager in 2011.

World Health Organisation

The World Health Organisation is a United Nations Agency whose mandate is global health was founded in 1948, with headquarters in Geneva, Switzerland. World Health Organisation (WHO) has a mandate in occupational health derived from its constitution, which identified WHO as "the directing and coordinating authority on international health work and stated WHO's functions which include the "promotion of economic and working conditions and other aspects of environmental hygiene. Also WHO's occupational health programme aims to promote the knowledge and control of workers' health problems, including occupational and work-related diseases, and to cooperate with countries in the development of health care programmes for workers, particularly those who are generally underserviced (ILO Content Manager, 2011).
According to WHO (2020) Fact Sheet of Action on Workers Health 2008-2017 World Health Assembly endorsed the following objectives:

- devising and implementing policy instruments on workers' health;
- protecting and promoting health at the workplace;
- improving the performance of and access to occupational health services;
- providing and communicating evidence for action and practice; and
- incorporating workers' health into other policies.

International Labour Organisation

The International Labour Organisation (ILO) is a United Nations Agency whose major responsibility is to make progress regarding social and economic justice through setting International Labour Standard.
International Labour Organisation has done a lot in the area of health and safety of industrial workers. According to ILO (2011) in 2010, the ILO embarked on the implementation of a project entitled "Improving Safety and Health at Work through a Decent Work Agenda. The project overall objective is "to contribute to a more inclusive society through a reduction in occupational accidents and work-related diseases. The project's expected results include: establishment of a National Dialogue process on Occupational Safety and Health; adoption of a national OSH programme; development of advocacy tools for promoting OSH. The

organisation is also involved in the implementation of the national HIV and AIDS workplace programme in Nigeria. It is involved in the process leading up to the development of a National Occupational Safety and Health Management System.

SELF-ASSESSMENT EXERCISE

i. Mention any 5 laws on occupational health and safety in Nigeria.
ii. Mention any four functions of Occupational Safety and Health Department of the Federal Ministry of Labour and Employment.

4.0 CONCLUSION

The achievement of health and safety of industrial workers is a collective responsibility of individuals, government, Labour Union and International Organisations. All hands must be on deck to rid our industries of injuries and death as a result of preventable accidents and diseases.

5.0 SUMMARY

In the unit you have been taught:

- constitutional provisions for occupational health and safety
- occupational health and safety law enforcement bodies.
- Roles of international organisations in the promotion of industrial health and safety.

This expository text is meant to rekindle the hope that health and safety of industrial workers is achievable in Nigeria.

6.0 TUTOR-MARKED ASSIGNMENT

1. What are the functions of an identified labour Union?
2. State major roles of International Organisations in the promotion of health and safety of industrial workers.

7.0 REFERENCES/FURTHER READING

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