

COURSE GUIDE

HED317 ENVIRONMENTAL HEALTH

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INTRODUCTION

Environment is made up of composite factors, which include physical, social, biological, chemical, cultural, and aesthetic environments. It is comprised of both the living things (man, plants, and micro-organism) and the non-living things (air, water, soil, and food) that coexist, bringing about life for each other (ecosystem). Man interacts constantly with the environment. The constant interaction with the environment has significantly affected the normal quality of the environment and this in turn affects man's health and longevity. Study of environmental health offers preventive and control measures to the impacts man's interactions with the environment have caused to man and to the entire ecosystem. Knowledge of environmental health therefore helps to provide the understanding of nature, the relationships that exist between living and non-living things and the required environmental health practices for controlling and maintaining the ecosystem in order to prevent environmental disasters, diseases and improve longevity.

WHAT YOU WILL LEARN IN THIS COURSE

This course HED317 will provide you with the knowledge of environmental health and this will specifically involve acquainting you with the knowledge of:

- (1) The relationships that exist in the environment,
- (2) Safe environmental health practices at home, community and schools,
- (3) The effects of the altered environment (e.g., pollution) and
- (4) The preventive and control measures required for ensuring safe and free environment in order to ward-off diseases, injuries and other related health problems arising from interactions between man and their environment.

COURSE AIM

The aim of this Course HED317 is to create and maintain an ambient, disease free environment in order to promote health and prevent diseases through teaching and learning.

COURSE OBJECTIVES

By the end of this course, the students should be able to:

- a) Describe environment and the ecosystem.
- b) Identify the available environmental health laws and the regulatory bodies that enforce the laws.

- c) Discuss the two forms of wastes and their managements.
- d) Discuss environmental pollution and the control measures.
- e) Discuss air, water, noise and soil and food pollution.
- f) Identify insect vectors that cause problems in the environment.
- g) Describe the qualities of good housing, identifying different types of housing, and their implications to environmental health.
- h) List and discuss the characteristics of school sanitation.
- i) Discuss occupational health services in relation to environmental health.
- j) State and discuss the various forms of Health Insurance and the benefits of Health Insurance.
- k) Discuss environmental impact assessment (EIA).

WORKING THROUGH THIS COURSE

This course has been divided into modules and units. For you to be successful in this course, you should read the course according to the given modules and the underlying units. You should read in a descending order, from module one to the end. This becomes important because the concepts precede each other in providing knowledge. This implies that your ability to understand the concepts in the proceeding module will help you to understand the concepts in the next. Try to also read introductory part of each module and units. They will help you in understanding what the concepts are all about. You will need to read each unit carefully and try to answer the Self-Assessment questions provided at the end of each unit. Your ability to answer the questions successfully will suggest that you have understood the unit and it will help you in understanding the concepts in the next unit. The course guide provided References/ Further Readings at the end of each unit. This will guide your further readings and to effectively make references, you should have computer for browsing. Use the provided references to also source for books and try to source for related materials from your University Library. The course guide has been comprehensively designed to equip you with the necessary and desirable knowledge on environmental health issues. For instance, drawings and pictures are provided in the course guide to give you a pictorial understanding of the given concepts. Read the concluding part of each unit. It will give you a practical understanding of the concept under the unit.

The Course Material

This course guide bears some major components which include:

- a) Presentation of schedule
- b) The Study Guide
- c) Modules

- d) Module Units
- e) Self-Assessment Exercises
- f) References/ Further Reading

STUDY UNITS

The course guide has seven (7) modules and nineteen (19) units which are presented in the following order:

Module 1 Environment, Ecology and Environmental Health Laws and the Regulatory Bodies

- Unit 1 Environment
- Unit 2 Ecology and Ecosystem
- Unit 3 Environmental Health Laws and the Regulatory Bodies

Module 2 Waste And Waste Management

- Unit 1 Dry Refuse or Solid Waste
- Unit 2 Methods of Final Disposal of Solid Waste
- Unit 3 Wet Refuse or Liquid Waste

Module 3 Environmental Pollution

- Unit 1 Concept of Environmental Pollution and Air Pollution
- Unit 2 Water Pollution
- Unit 3 Noise Pollution
- Unit 4 Soil Pollution
- Unit 5 Food Hygiene and Food Pollution

Module 4 Vector Control

- Unit 1 Arthropods and Zoonosis
- Unit 2 Vector Control

Module 5 Housing and School Sanitations

- Unit 1 Housing and Environment
- Unit 2 School Sanitations

Module 6 Occupational Health Services (OHSs)

- Unit 1 Occupational Health Services and Occupational Health Hazards
- Unit 2 Health Insurance

Module 7 Environmental Impact Assessment (EIA)

- Unit 1 Concept and Definition of EIA
Unit 2 Environmental Sensitive areas

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ASSIGNMENT FILE

There is provision for continuous assessment in this course in addition to the self-Assessment Exercises and final examination. The continuous assessment (CA) will be Computer- based Assessment and it will be done three (3) times within the period of the study. The Open University time table of events will determine the suitable time when each of the CAs will be given. The CAs will be submitted to your facilitator who will grade each of them 10 per cent, bringing the total score to 30 per cent. Examination will be taken by the end of the course and the maximum score for the examination will be 70 per cent. Your promptness, in submission of the assignments and your effectiveness in attempting the Self- Assessment questions will help you in achieving success in this course.

TUTOR MARKED ASSIGNMENT (TMA)

The Tutor Marked Assignment (TMA) for this course will be three (3) and these will be marked and graded by your facilitator. For you to be eligible to take the examination, you must have completed the assignments and submitted them to your facilitator. In case where you have problem in submitting your assignment within the stipulated time, try to discuss the problem with your facilitator for possible advice. The TMA will yield maximum of 30 per cent while the examination will be maximum of 70 per cent.

FINAL EXAMINATION AND GRADING

The final examination for this course 335 will last for 3 hours. The questions that will be provided for the examination will be drawn from the course guide. The examination questions will revolve around the Self-Assessment questions provided at the end of each unit of the course guide and the continuous assessment given within the course period. It then becomes expedient that you read through the concepts in each unit thoroughly and try to answer the underlying questions. This will help you to evaluate the extent you have learnt the concepts before writing the examination.

PRESENTATION SCHEDULE

The presentation schedule for the TMA will be provided by the Open University. The examination date will equally be contained in the

University time table of events. Try to be prompt in complying or following the university time table of event so as to meet up with all the requirements necessary for you to be eligible to write the examination.

Table 1: Course Marking Scheme

Assignment/Examination	Grades
Assignment 1	10%
Assignment 2	10%
Assignment 3	10%
Total	30%
Examination	70%
Grand Total	100%

Course Overview:

Course Code: HED 335
 Course Title: Environmental Health
 Credit Unit: 2
 Course Status: Non Elective
 Semester:
 Course Duration: 15 weeks

Table 2: Course Overview

Module	Unit	Week	Activity	TMA	Duration
Module 1	1 and 2	1	Environment and Ecosystem		2 hours
Module 1	3	2	Environmental health Laws and Regulatory bodies		2 hours
Module 2	1	3	Dry Refuse or Solid Wastes		2 hours
Module 2		4	Methods of Final Disposal of Solid Wastes	TMA1	2 hours
Module 3	1 and 2	5	Environmental Pollution and Air Pollution		2 hours
Module 3	3 and 4	6	Water Pollution and Noise Pollution		2 hours
Module 3	5	7	Soil Pollution and Food Pollution		2 hours
Module 4	1	8	Arthropods and Zoonosis		2 hours
Module 4	2	9	Vector Control	TMA 2	2 hours

Module 5	1	10	Housing and Environment		2 hours
Module 5	2	11	School Sanitation		2 hours
Module 6	1	12	Occupational Health Hazards		2 hours
Module 6	2	13	Health Insurance		2 hours
Module 7	1	14	Concepts and Definitions of EIA		2 hours
Module 7	2	15	Environmental Sensitive Areas	TMA3	2 hours

HOW TO GET THE MOST FROM THIS COURSE

This course guide has been designed to give you the best and the required knowledge of environmental health. To get the most from the course HED 335, you should adhere to the following:

- i. Read the preliminary pages carefully to understand the aims, objectives and guidelines stipulated for attaining success in this course.
- ii. The modules and units were introduced before the main contents. Read the introductory aspect of each module and unit to have pictorial view of what the concepts of the module or unit are all about before reading the concepts as contained in the module or units.
- iii. The modules and units are sequentially arranged such that your knowledge of the first leads to your knowledge of the second and so on. You should therefore read from module one down to the last module. This equally applies to the underlying units.
- iv. Critically study the intended learning outcomes which are provided before the main contents. It will guide your understanding of what you are expected to learn from each unit.
- v. The Self-Assessment Exercises that are provided at the end of every unit should be given adequate attention. Attempt the questions, go back to the contents and attempt the questions again. Do this over and over until you certify that you have performed optimally in that unit then you go to the next unit.
- vi. Try to always chunk out points as you read and read to understand the concepts and not to memorize them. Environmental Health is a practical subject that should be learnt and not to be memorized.
- vii. The references and links that are provided are meant to guide your further readings and expansion of knowledge. It is therefore advisable that you have your personal computer for browsing. You should also try to procure some of the recommended books and equally source for information from the University library.

- viii. Study the drawings and their labelling very cheerfully and match the pictures with the corresponding concepts to have more grips of what the concept is all about.
- ix. Your surrounding environment should serve as a practical example to what you have read from the course. You should therefore observe critically the events, changes and practices as they occur in your environment. It will aid you in having a full grasp of the concepts or contents of the course as you read them. It will also help you in finding meaning in your studying environmental health as a course.
- x. Try also to comply with rules and regulations as have been provided by the Open University authority
- xi. Submit your TMA within time and follow all the instructions as may be given to you by your facilitator. In other words, ensure maximum cooperation with your facilitator.

FACILITATOR/TUTORS AND TUTORIALS

Learner centered facilitation will be provided online for the success of this course. It will be the responsibility of the facilitator to coordinate all activities required, have correspondences with the University authority, mark the TMA, score them and submit the result to the appropriate quarter in the University. The facilitator is also responsible for addressing the problems and needs of the students in relation to teaching and learning of this course HED 335.

SUMMARY

Health promotion and maintenance is dependent upon the ability of man to maintain a healthy and safe environment. This is the surest way to improved quality of life and longevity. Man's activities in the environment have been a huge source of problem to man and the entire environment. The interaction between man and the environment has resulted to environmental degradations and this has given rise to diseases and environmental disasters (flooding, earthquake). The ecosystem has been altered, creating problems for both the living and non-living parts of the environment. This course guide has been designed for the interest of teaching and learning of issues related to environmental health. It is expected that by the end of this course, the student should be able to learn about the concepts of environmental health, and the components of environmental health which include; The types and consequences of poor environment.

- The ecosystem.
- Waste generations and management.
- The environmental health laws and the regulatory bodies.

- Environmental pollution (air, water, soil, noise and food).
- Vector and vector control.
- Housing and school sanitation.
- Occupational health services.
- Environmental impact assessment.

The students' exposure to the knowledge of the above component of environmental health will help them in adopting proper environmental health practices. It will help them in carrying out advocacy within their community and in the wide environment on suitable measures and practices to be adopted to enhance environmental health safety and protection. Hence, diseases, disasters, cultural alterations and other environmental health challenges that are threatening man and the environment in the recent decades will be put in check.

**MAIN
COURSE**

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MODULE 1 ENVIRONMENT, ECOLOGY AND ENVIRONMENTAL HEALTH, LAWS AND REGULATORY BODIES
MODULE INTRODUCTION

Man has been the major cause of damage to the entire atmosphere and has the capacity to alter the ecosystem. The environment is a composite term that consist of land, water, food, air, housing and other aspects of nature that determine man's existence on earth. The interactions between man and the environment have resulted to environmental degradations. For instance, the increase in the greenhouse gases and the destruction of ozone layer has significantly resulted to changes in weather patterns and this is expected to give rise to global warming in the near future. The problem of environmental degradations has also engendered some tropical diseases that threaten man and other living organisms. This has called for the establishment of laws on the protection of the environment and the regulatory bodies that secure compliance of the laws, where the laws are not adhered to. In this module, the environment, ecology and environmental health laws and the regulatory bodies will be discussed.

Unit 1	Environment
Unit 2	Ecology and Ecosystem
Unit 3	Environmental Health Laws and the Regulatory Bodies

UNIT 1 ENVIRONMENT

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1.0	Introduction
2.0	Objectives
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3.1	Definitions of Environment and Environmental Health
3.1.1	Environment
3.1.2	Environmental Health
3.2	Classification of Environment and their Effects on Man
3.2.1	Physical Environment
3.2.2	Biological Environment
3.2.3	Social Environment
3.2.4	Other Environments
3.3	What Constitute Poor Environment
3.4	Consequences of Poor Environment
4.0	Conclusion
5.0	Summary
6.0	Tutor Marked Assessment
7.0	References/Further Reading

1.0 INTRODUCTION

This unit will help you to understand the meaning of environment. It will classify environment and show effects of the various classified environment on man. In this unit also the factors that constitute poor environment as well as the consequences of poor environment will be identified.

2.0 OBJECTIVES

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

- Define Environment
- Explain the classes of environment
- Discuss the effect of each class of environment on man.
- Identify the factors that constitute poor environment
- List the consequences of poor environment.

3.0 MAIN CONTENT

3.1 Definitions of Environment and Environmental Health

3.1.1 Environment

Environment refers to conditions in which man and other organisms including non-living organisms such as air, water, sunlight, food, housing, soil, atmosphere, thrive and live for each other's life. This implies that both living and non-living organisms constitute the environment and they coexist, bringing about life for each other. The word "environment" has been given various definitions by so many authors. It is the whole complete of physical, social, biological, cultural and aesthetic factors which affect individual and communities and ultimately determine their form, character, relationship and survival. Environment is also defined as the forces, conditions or circumstances that surround and affect lives. Man's total environment includes all the living and non-living elements in his surroundings which form the two factors of the environment. These factors include **Abiotic** and **Biotic** factors.

Abiotic Factors: These are the non-living components in the environment such as climatic factors, e.g., temperature, rainfall, humidity, light, soil and so on.

Biotic Factors: These are the living components such as man, animals, fungi, bacteria, worms and so on. Both the biotic and abiotic components interact together to form a complex relationship.

3.1.2 Environmental Health

Environmental health has to do with the study of environment and the relationship it has with health. The major interest of environmental health is to create and maintain an ambient, disease free environment in order to promote health and prevent diseases. Environmental health is defined as the process of taming the environment so that it no longer constitutes a hazard to man. Environmental health is concerned with:

- Environmental constituents
- Provision of safe and adequate supply of water
- Disposal of wastes
- Safeguarding of food
- Provision of good housing
- Control of animal reservoirs of infection
- Air hygiene and prevention of environmental pollution
- Elimination of other hazards such as noise, radiation etc.

3.2 Classification of Environment and their Effects on Man

Environment can be classified into the following:

3.2.1 Physical Environment

This consists of the naturally existing aspect of the environment. It refers to non-living things such as climatic factors like rainfall, sunlight, humidity and edaphic factors consisting of soil composition, soil form and soil temperature.

The physical environment has direct effect on man and the effects varied in line with the varied physical environment from place to place.

- i) Natural disasters among which are earthquakes, the waves of the high seas or over flowing of river banks, erosion, desertification and so on.
- ii) Physical comfort which comes from the air, temperature, humidity, rainfall and other natural sources.
- iii) Distribution of plants and animals in various parts of the earth and presence of vegetation. This gives opportunity for food productions, shelter, clothing, animal rearing and so on.
- iv) Provision of different types of transportation and communication system. For instance, people who live where there is no river or sea travel with motorcycle, motor car and bicycle.
- v) Different places have different seasons such as rainy season,

- dry season, winter, etc. This affords different opportunities for agricultural activities resulting to varied food productions.
- vi) Because of the difference in climatic factors, the distribution of carnivorous animals varies from place to place. Some areas have dangerous animals that prey on man and compete with man for survival.
 - vii) Parasites such as mosquitoes that cause malaria, black flies that cause filarial are distributed in some tropical areas.

3.2.2 Biological Environment

This refers to the living things in the environment.

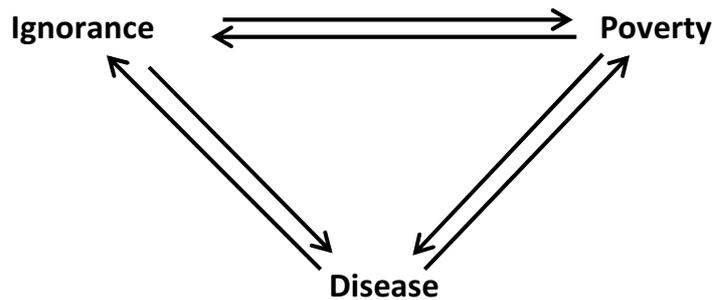
Under this, we have man, animals, plants and micro-organisms.

- a) These groups of living things are inter-dependent on each other and absolutely depend on the physical environment for their survival. For instance, the sun is the source of the energy and this energy is trapped by plants during photosynthesis for the manufacturing of its food, animals feed on these green plants (herbivores) while some group of animals feed on other animals (carnivores) or feed on both plants and animals (omnivores).
- b) Death is a natural mechanism which is made to ensure a balance in the inter-relationship between all populations in the environment. All the species of living things die to produce young ones. This controls the growth and size of the population of all species.
- c) Man in its desperate move to survive cultivate plants that provide him food, clothing, shelter and keep animals for provision of meat, milk, wool etc. man also devices means of survival by destroying parasites, vectors and other insects that are capable of transmitting diseases to man.

3.2.3 Social Environment

This is the community facilities and services, culture and interactions that exist between groups of organism. It is also the relationship between one group of organism and the other.

- a) There has been a lot of modernisation in some countries with its attendant social problems. In these modernised countries, diseases have been brought under control and life span has improved. Some countries are still held tightly in ignorance, poverty and disease. This is illustrated in figure below.



- b) Social environment entails culture and culture is an all-embracing concept which includes language, beliefs, educational system, attitudes, health services and communications. Cultural enhancement helps in man's existence since it brings about control and eradication of major endemic diseases, poverty and ignorance.
- e) Some countries are still engulfed by man-made problems such as cigarette smoking, alcoholism, prostitution, drug abuse and so on. This results from the fact that they are in transition moving from one level of development to the other (from under development through developing to developed). In this case, they are faced with problems of both the developed as well as underdeveloped problems.
- d) The population explosion together with technological advancement, have resulted in increase desire for high standard of living and better comfort, and thus maximise the technical ability of successive generations to explore and exploit the environment. This environmental exploitations lead to the modification and adoption of new culture e.g., change of diet, language, dressing and so on. In attempt to classify the environment some researches added the following:

3.2.4 Other Environments.

These include:

- i) **Aesthetic Environment:** This refers to scenic areas and the vistas
- ii) **Economic Environment:** Such as issues relating to employment and wealth creation.
- iii) **Chemical Environment:** The proliferation of new chemicals, addition of chemicals to rivers, seas, which gets to the system of fish etc.

3.3 Factors that Constitute Poor Environment

1. Indiscriminate disposal of refuse in an environment
2. Absence or unsanitary provision of toilet facilities resulting in poor disposal of sewage within the surrounding.
3. Bushes and tall grasses around the surroundings.
4. Presence of offensive odour in the environment
5. Dirty drainage and lack of drainage system
6. Litters of dangerous objects and open cans in the surroundings.
7. Poor or inadequate ventilation in living houses and workplaces
8. Absence or inadequate supply of portable water

3.4 Consequences of Poor Environment

1. Gross insanitation - The more the population in an environment the more the refuse generated.
2. Loss of space
3. Precociousness or survival of the fittest
4. Aggressiveness among members which can lead to precarious environment or signs of depression such as stress, anxiety, fear etc
5. Decline in sexual desire due to stress related factors
6. Homosexuals may be found among members
7. Infertility
8. There may be child neglect and abuse
9. Damage to the endocrine gland
10. Other environmental illnesses may occur such as blood disease, high blood pressure, lung disease, heart disease, accident etc
11. There is economic loss.

SELF-ASSESSMENT EXERCISES

1. Define the term environment
2. Describe the following classes of environment:
 - i. Social Environment
 - ii. Economic Environment

4.0 CONCLUSION

Proper understanding of the term environment and what constitute poor environment is very important in controlling human practices that cause problems to the environment.

5.0 SUMMARY

Environment has been given various definitions in this unit. It is not just the atmosphere but involves physical, social, biological, cultural and aesthetic economic and chemical factors, which affect man and other living organisms. The activities of man has also been seen to have effect on the environment which in turn brings about negative consequences to man.

6.0 TUTOR MARKED ASSESSMENT

1. Give the concept of environmental health.
2. Identify any five factors that constitute poor environment.
3. Discuss the consequences of poor environment.

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UNIT 2 ECOLOGY AND ECOSYSTEM

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Ecology and Environment
 - 3.2 Factors responsible for Ecological Changes
 - 3.3 Ecosystem
 - 3.3.1 Primary Link in Ecosystem
 - 3.3.2 Characteristics of Ecosystem
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor Marked Assessment
- 7.0 References/Further Reading

1.0 INTRODUCTION

There are some relationships that exist between living things and non-living things in the environment. This inter-relatedness is described as the process of give and take between living things and between living and non-living things in the environment. This unit will discuss ecology and environment, causes of ecological changes and the ecosystem.

2.0 OBJECTIVES

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

- Define ecology.
- Explain the relationship between ecology and environment.
- Describe the factors that give rise to ecological changes.
- Explain the term ecosystem.
- Discuss the primary link in the chain of ecosystem.

3.0 MAIN CONTENT

3.1 Ecology and Environment

Ecology is defined as the science concerned with the relationship between living things and between living things and their environment. It is the scientific study of the interactions that determines the distribution and abundance of organism.

Ecology and environment are inter-related because of the process of give and take that goes on in an environment. In other words, ecology

is interested in what living organism gives to the surrounding and what it takes from the surrounding. The study of ecology is based on the realisation that natural resources of the earth are limited and for man to survive, there must be means of developing appropriate management strategies that will ensure the continuous supply of these limited resources to man. These natural resources include temperature, water, air, climate, soil etc.

3.2 Factors Responsible for Ecological Changes

Ecological changes may result from changes in natural events, human activities, agricultural activities, water related activities, air related activities etc.

- i. **Natural Events:** This includes meteorological issues like climatic change, which may be as a result of changes in the normal pattern of various climatic conditions thereby giving rise to different ecological changes such as overheating, overflooding, erosion, windstorm, hurricanes, bush burning, tectonic events (volcanic eruption, earthquake, landslide etc).
- ii. **Human Activities:** This includes dam construction, road construction, mining, quarrying, petroleum exploration and urbanisation. These activities may give rise to air and water pollution, low water flow; bring about sedimentation, population increase, migration, flooding, epidemics, gully erosion, noise pollution, housing problems, overcrowding etc.
- iii. **Agricultural Activities:** Land clearing and preparation, introduction of hybrid materials, application of fertilisers on soil ecosystem which may cause soil infertility. Other factors such as motor engines operation and industrial gas which leads to the emission of dangerous gases like carbon monoxide, hydrocarbon, also affect the environment.
- iv. **Water Related Activities:** This include fishing, oil exploration and exploitation, water dredging, industrial waste disposal, clearing of water hyacinth, other activities in the petroleum industries like gas flaring, oil spillage and gas emission.
- v. **Air Related Activities:** Flying of jets, emission from airlines, quarrying activities releasing particles, military activities, industrial waste gas, carbon-monoxide, hydrocarbon, sawmill exudates, vehicular exhausts etc.

3.3 Ecosystem

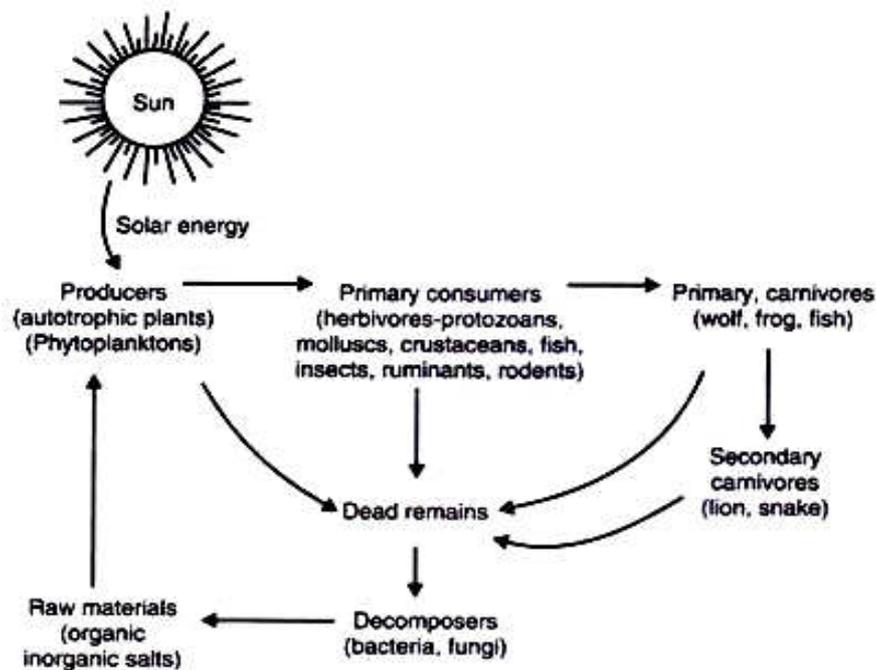
The ecosystem is defined as a group of organism and their physical environment reacting together as a system. It is a sum total of the

living and non-living parts of a system which support a chain relationship of life within a selected area.

A system being a set of things considered as a collected whole, implies that the normal function of the whole depends on the component part and no component part can function without the whole. For example, human system is made up of so many organs and when one organ is affected, the entire system will equally be affected.

3.3.1 Primary Link in Ecosystem

Fig 1: The Primary Links in the Chain of the Ecosystem



(Culled from Ecological community/ curcehero.com)

Four primary links in ecosystem exist namely:

- i. **Energy Flow and the Material Circles:** This is equally known as the non-living part of the ecosystem that sustains life. Under this, we have oxygen, organic component, sunlight, water, air, carbon dioxide etc.
- ii. **The Autotrophic Components or the Producer:** This is referred to as the cell nourishing components of the ecosystem. These include grass, shrubs, microscopic hydro-planktons found in water and trees.
- iii. **Heterotrophic Components or Consumers:** They utilise materials produced from autotrophic and they operate at two levels namely:

- a. . **Primary Consumer:** The herbivores which include cow, sheep, goat. They feed directly from the plant.
- b. . **Secondary Consumer:** The carnivorous that feed directly from the plants and the herbivorous under this, we have man, lion, leopards etc.
- iv. **Decomposers:** These are microorganisms which break down the dead producers and dead consumers and recycle their chemical compound to the ecosystem for reuse by the plant or the producers e.g. viruses, fungi, bacteria, etc.

3.3.2 Characteristics of Ecosystem

- i) Ecosystem recycles its elements because the producer depends on constant energy supply and the consumers depend on the producer. In turn, the consumers die and decompose and become raw materials that feed the producers.
- ii) It has constant source of sunlight or energy. It incorporates energy into its system which does not stop. The moment the energy is lacking, the producer will collapse.
- iii) It transfers energy from one source to another because the producer, consumers and the decomposers require energy to function in the ecosystem.

SELF-ASSESSMENT EXERCISE

1. Define Ecology
2. Discuss the factors that give rise to ecological changes
3. Describe the primary link in the chain of ecosystem

4.0 CONCLUSION

The acquisition of knowledge of ecology and understanding the ecosystem and environment is crucial in controlling man-made factors that interfere with the normal flow of the ecosystem. It will help you in appreciating nature and the relationship that exist between living and non-living things.

5.0 SUMMARY

This unit described the meaning of ecology, the relationship between ecology and environment, and the factors that lead to ecological changes. It also explained the term ecosystem and discussed the primary links in the chain of ecosystem.

6.0 TUTOR MARKED ASSESSMENT

1. Describe the primary link in ecosystem.
2. Disuse characteristics of ecosystem.

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UNIT 3 ENVIRONMENTAL HEALTH LAWS AND THE REGULATORY BODIES

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Environmental Health Laws in Nigeria
 - 3.1.1 Types of Environmental Health Laws
 - 3.2 Environmental Health Regulatory Bodies in Nigeria
 - 3.2.1 Roles of the Regulatory Bodies
 - 3.3 The Non-Governmental Organizations (NGOs)
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor Marked Assessment
- 7.0 References/Further Reading

1.0 INTRODUCTION

Man has been known to have the propensity for creating problems in the chain of ecosystem. For instance, the production of chemicals, emissions from industries and other hazardous substances have altered the natural environment such as water, soil, air, plants and even aquatic lives. It is in order to preserve the natural environment that rules and regulations are enacted in form of laws and regulatory bodies are established to control and enforce compliance to principles guiding the preservation of natural environment and ecosystem in order to prevent diseases, promote and maintain health. This unit will discuss environmental health laws and the regulatory bodies in Nigeria.

2.0 OBJECTIVES

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

- Define environmental health laws.
- State the types of environmental health laws.
- State the roles of the NESREA.
- Identify the various environmental regulatory bodies in Nigeria.
- State the roles of the environmental regulatory bodies that operate under the egis of the NESREA.

3.0 MAIN CONTENT

3.1 Environmental Health Laws in Nigeria

Environmental health laws are rules and regulations enacted to control and enforce the rules meant for observing principles of personal and environmental hygiene, control environmental pollution and degradation and for sustenance of the ecosystem in order to maintain and promote health.

3.1.1 Types of Environmental Health Laws

- **Harmful Waste Act:** This law prohibits the carrying, depositing and dumping of harmful waste on land and in territorial waters.
- **Endangered Species Act:** This provides for the conservation and management of wildlife and the protection of endangered species, as required under certain international treaties.
- **National Oil Spill, Detection and Response Agency Act (NOSDRA):** The objective of this law is to put in place machinery for the co-ordination and implementation of the National Oil Spill Contingency Plan for Nigeria to ensure safe, timely, effective and appropriate response to major or disastrous oil pollution.
- **National Park Services Act:** This makes provision for the conservation and protection of natural resources and plants in national parks.
- **Nigerian Minerals and Mining Act:** This is for the regulating of the exploration of solid minerals, among other purposes.
- **Water Resources Act:** This aims at promoting the optimum development, use and protection of water resources.
- **Hydrocarbon Oil Refineries Act:** The Act is concerned with the licensing and control of refining activities.

3.2 Environmental Health Regulatory Bodies in Nigeria:

The major federal regulatory body that is in charge of environmental protection in Nigeria is the National Environmental Standards Regulations and Enforcement Agency (NESREA). It was established under the act 2007. In 1999, the minister of environment made some regulations under this Act. The NESREA is responsible for enforcing all environmental health laws, regulations, guidelines and standards. Their roles include enforcement of environmental conventions, treaties and protocols. All other regulatory bodies operate under the auspices of the NESREA. Every state in Nigeria has its own regulatory bodies. These bodies include:

- National Environmental Standards and Regulations Enforcement Agency (NESREA)
- National Oil Spill Detection and Response Agency
- Federal Ministry of Environment
- Directorate of Petroleum Resources (DPR)
- Nigerian Nuclear Regulatory Authority
- Federal Ministry of Water Resources
- National Oil spill Detection and Response Agency (NOSDRA)
- National Bio safety Management Agency
- Department of Climate Change
- Energy Commission of Nigeria
- Erosion, Floods and Coastal Zone Management
- Department of Planning, Research and Statistics
- Drought and Desertification Agency

3.2.1 Roles of the Regulatory Bodies

The NESREA is responsible for taking pre-emptive measures to ensure compliance with relevant legislative requirements and licensing provisions while the agencies try to enforce compliance where it is not forthcoming. The subordinate bodies' major enforcement strategies include:

1. Environmental inspection.
2. Environmental monitoring.
3. Negotiation.
4. Legal action.
5. Prosecution.
6. They also issue licences and environmental permits, prohibitions, and enforcement notices on environmental issues.

3.3 Non-Governmental Organizations (NGOs)

There are some environmental non-governmental organisations (NGOs) that also play important roles in environmental protection. They help in enforcing environmental health laws. These NGOs partner with the NESREA at the federal, state and local government levels; the NGOs include:

Civil society organisations (CSOs)
 State planning authorities
 Community based organisations (CBOs)
 Faith based organisations (FBOs)
 Non-governmental organisations (NGOs)
 International community and donor agencies

SELF- ASSESSMENT EXERCISE

1. Identify any five types of environmental health laws.
2. Identify any six NGOs that partner with the NESREA in ensuring environmental safety.

4.0 CONCLUSION

Your understanding of the various environmental health laws and different regulatory bodies in Nigeria is important because it will help you to understand the environmental health practices required of you within your immediate and wide environment and therefore modifies your obnoxious health practices that affect the environment.

5.0 SUMMARY

In this unit, environment health law is defined and the various types highlighted. The unit also revealed the different regulatory bodies and their rules in securing compliance to the law.

6.0 TUTOR MARKED ASSESSMENT

1. State the major enforcement strategies of the regulatory bodies operating under the egis of the NESREA.
2. Discuss the role of the regulatory body.
3. Identify the subordinate bodies that operate under the NESREA.

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MODULE 2 WASTE AND WASTE MANAGERMENTS

MODULE INTRODUCTION

You have learnt in the preceding module about the meaning of environment, the ecosystem that brings about interconnectivity between the living and non-living things in the environment. You have also learnt about the environmental health laws and the regulatory bodies that help in enforcing the laws in order to maintain the ecosystem, create free and safe environment and promote health and wellbeing. In this module, the means for creating free and safe environment which is waste disposal and waste management will be discussed.

Unit 1	Dry Refuse or Solid Wastes
Unit 2	Methods of Final Disposal of Solid Wastes
Unit 3	Wet Refuse or Liquid Waste

UNIT 1 DRY REFUSE OR SOLID WASTE

CONTENTS

1.0	Introduction
2.0	Objectives
3.0	Main Content
3.1	Types of Solid Waste
3.1.1	Domestic Waste
3.1.2	Estate Solid Waste
3.2	Objectives of Solid Waste Management
3.3	Environmental Effects of Solid Waste
3.4	Stages in Solid Waste Handling and Disposal
3.5	Factors to be considered before Selecting Methods of Solid Waste Disposal
4.0	Conclusion
5.0	Summary
6.0	Tutor/Marked Assessment
7.0	References/Further Reading

1.0 INTRODUCTION

The term disposal of waste refers to environmental sanitation because both terms are all about the process of controlling the physical environment to make it clean, free and safe for human habitation, animal safety and for protection of properties. This unit will discuss the types of solid waste that are being generated in the environment and the effects of these wastes on the inhabitants of the environment. It will equally reveal the stages in handling and disposal of solid waste and identify the

factors to be considered before selecting methods of solid wastes disposal.

2.0 OBJECTIVES

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

- Discuss the types of solid waste.
- List the objectives of solid waste.
- State the environmental effects of solid wastes.
- Describe the stages in solid waste handlings and disposals.
- List the various factors to be considered before selecting methods of solid waste disposal.

3.0 MAIN CONTENT

3.1 Types of Solid Waste or Dry Refuse

The term disposal of waste refers to the process of controlling the physical environment to make it free and safe for human habitation, animal safety and protection of properties. Refuse is divided into two types namely dry refuse or Solid waste and wet refuse or Liquid waste. Dry refuse is equally known as solid wastes. It can be defined as unwanted, or any discarded materials arising from human's activities and which are not free flowing. These include: (A) Domestic waste and (B) Estate Solid wastes.

3.1.1 Domestic Wastes

Under this we have

- i) Garbage
- ii) Rubbish
- iii) Ashes
- iv) House sweepings
- v) Other Bulky wastes

Garbage: These are waste resulting from household handling preparation, cooking and consumption of food. Examples are yam peelings, banana peels, ruminants of vegetables and so on.

Rubbish: These are wastes generated from combustible and non-combustible substances excluding ashes. They include wools, rubbers, cans, glass, metals, beddings, cottons, disused clothing and shoes, etc.

Ashes: These are wastes generated from the combustion of coal, fire wood and other wood products. The residues collected therefore are referred to ashes.

House Sweepings: These are wastes generated from dirties and worn-out surfaces, dropped dead leaves and waste papers.

Other Bulky Wastes: These are wastes generated from disused old refrigerators, furniture, rubber, tyres, abandoned vehicles, and so on.

3.1.2 Estate Solid Wastes

- i) Industrial wastes
- ii) Hospital wastes
- iii) Municipal wastes
- iv) Agricultural wastes

Industrial Wastes: These are solid wastes generated from industries such as, paper processing industry, iron and steel industries, sawmill industry, iron and steel industries, sawmill industry, water aerated factories e.g., plastic, packaging wastes etc.

- **Hospital Wastes:** These refers to wastes generated from the hospitals and medical laboratories such as discarded disposable needle, syringes, disused dressing materials, discarded bandages, swabs and disused slides, pads, rolls, comical containers already used etc.
- **Municipal Wastes:** These are wastes generated by the public of which no body is attached of responsible for it. Under this we have street litres, abandoned old trucks, dead animals etc.
- **Agricultural Wastes:** These are generated agricultural activities and products, agricultural producing and processing industries examples, are rice and beans shafts, maize cobs, cocoa, pods, and leaves.

3.2 Objectives of Solid Wastes Management

1. To prevent water, and air pollution
2. To prevent soil contamination and degradation

3. To eliminate health hazards and toxic substances injurious to man and his environment.
4. To provide material for salvaging and recycling.
5. To provide employment for the jobless population
6. To destroy or eliminate pathogenic organism

3.3 Environmental Effects of Solid Waste

1. Accidental fire outbreak
2. Atmospheric air Pollution
3. Emission of offensive odour
4. Attraction of rodents and flies infestation
5. Flooding and blockage of drains
6. Traffic accident
7. Pollution and contamination of water sources
8. Transmission of diseases - dysentery, diarrhoea, cholera, typhoid fever, oncocerciasis etc
9. Breeding of mosquito leading to spread of malaria and dengue fever
10. Lung and throat irritation.

3.4 Solid Waste Handling and Disposal

These include refuse generated from domestic and estate environments.

- 1) Disposal of solid wastes starts with the picking or sweeping of the room or houses environment (point of production)
- 2) The collected wastes is usually put into a plastic or metal refuse bin and stored for a few hours or days-as the case may be.
- 3) The refuse is then transported to the trail disposal site.
- 4) From there it undergoes the final disposal method.

3.5 Factors to be considered before Selecting Methods of Solid Waste Disposal

1. Population of the community
2. Refuse generation capacity of the populace
3. Cost
4. Distance of the community to the disposal site (proximity)
5. Consideration of underground water
6. Avoidance of air pollution
7. Prevention of odour nuisance
8. Consideration of the aesthetic look of the environment
9. Simplicity in operation and ability to maintain the method
10. Acceptability of the method in terms of culture and people's choice

11. Availability of land

SELF-ASSESSMENT EXERCISE(S)

1. Define the term solid waste.
2. Identify any six effects of solid waste.
3. List any five factors to be considered before selecting methods waste disposal.

4.0 CONCLUSION

The knowledge you have acquired from this unit will help you to understand the impact solid wastes have on the ecosystem. It will equally help you to know the appropriate measures to be adopted in handling wastes from the point of generation to the final disposal point.

5.0 SUMMARY

You have learnt from this unit the definition of solid wastes and the effects of solid waste to the inhabitants of the environment. This unit also acquainted you with the knowledge of the stages in solid waste handling and disposal as well as the factors that should be considered in selecting methods of solid waste disposal.

6.0 TUTOR/MARKED ASSESSMENT

1. Discuss the stages in solid waste handling and disposal.
2. What are the objectives of solid waste management?
3. Discuss the following:
4. Domestic waste.
5. Estate solid waste.

7.0 REFERENCES/FURTHER READING

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UNIT 2 METHODS OF FINAL DISPOSAL OF SOLID WASTES

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Conventional Methods of Final Disposal of Solid Waste
 - 3.1.1 Burning
 - 3.1.2 Sanitary Landfill
 - 3.1.3 Hog Feeding
 - 3.1.4 Dumping into the sea
 - 3.1.5 Open Dumping
 - 3.1.6 Composting
 - 3.1.7 Decomposition
 - 3.2 Non-conventional Methods of Final Disposal of Solid Waste
 - 3.2.1 Incineration
 - 3.2.2 Pulverization
 - 3.2.3 Pyrolysis
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor/Marked Assessment
- 7.0 References/Further Reading

1.0 INTRODUCTION

In the first unit of this module, we discussed among others, the stages in solid waste handling and disposal, starting from the point of generation of the solid waste to the point of its final disposal. In this unit, you will learn the various methods of final disposal of solid wastes, the advantages and the disadvantages of each method will equally be discussed.

2.0 OBJECTIVES

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

- Discuss the conventional methods of solid waste disposal, showing the advantages and disadvantages.
- Discuss the non-conventional methods of solid waste disposal, identify their advantages and disadvantages.

3.0 MAIN CONTENT

3.1 Conventional Methods of Final Disposal of Solid Waste

(1) Burning (2) Sanitary land fill (3) Hog feeding (4) Dumping into the sea (5) Open dumping (6) Composting

3.1.1 Burning:

Burning method of solid waste disposal is a primitive method. The refuse are packed in a metal drum or in an open place and then it is set ablaze so as to burn the combustible part of the refuse.

Advantages

- i) It is simple to operate
- ii) It is very cheap
- iii) It doesn't need much skill for operation

Disadvantages

- i) It could lead to fire accident
- ii) It can cause air pollution
- iii) The incombustible part of the refuse left behind later develops as receptacles, holding water for mosquitoes breeding places.

3.1.2 Sanitary Landfill

This is a controlled method of disposing wastes. It is done by spreading wastes in layers, and covering them with soil in order to reduce environmental health hazard or nuisances.

It could be used to fill up an already excavated area or an excavation which is very deep (this depends on the type of refuse to be disposed), from 4 meter and above in depth.

- Refuse are arranged in layers which should not be less than 15cm for disposal of materials and 60cm for dead animals.
- The incombustible refuse are beaten flat and laid at the bottom of the excavation
- The combustible wastes should be laid on top of it, and should be covered

- with soil until the next tip.
- The land being filled should be fenced round to prevent stray animals and all precautions should be taken to prevent fire accident.

Advantages

If this method is properly managed

- i) It will reduce rodent and flies infestation
- ii) It is very economical
- iii) It is very simple to operate
- iv) It can be used to dispose different types of waste
- v) It provides job opportunity
- vi) It prevents air pollution
- vii) It helps for land reclamation.

Disadvantages

If not properly managed it can cause:

- i) Pollution of sources of water as a result of leaking
- ii) It can degenerate into an open dump
- iii) It can led to fire hazards
- iv) It can attract rodent and flies
- v) Logistics problem may enhance its stoppage
- vi) It requires technical application of skill
- vii) It requires money.

3.1.3 Hog

Feeding

This is a method in which refuse such as garbage are used for feeding of domestic animals like goat, cattle and swine. The major disadvantage in this method is that researchers have proved that it causes taeniasis in domestic animals which is later transmitted to man through consumption of the affected animal.

3.1.4 Dumping Into the Sea

This is a common method used by people in riverine areas. In this case, refuse is being dumped into the sea, river etc. This method is very

dangerous as to could result to the blockage of water channel leading to flooding. It can also endanger aquatic lives. It can lead to water pollution.

3.1.5 Open Dumping

This is a method in which refuse is thrown into an open area uncontrollably without minding the public health implications. This type of disposal method constitutes a lot of disadvantages rather than advantages.

Disadvantages

- a) It causes offensive odour
- b) It attracts vermin and rodents and houseflies giving rise to mechanical transmission of disease. When rainfall and leakages occurs, it contaminates or pollute sources of drinkable water -
- c) When rain carries the refuse to fill the public drains, it results to flooding, destruction of houses, life and property.

3.1.6 Composting

This is a process by which organic matters (waste matters) are broken down by actions of bacteria and fungi to turn it into manure or humus - like material. It consists of three major processes namely:

- a) Preparation of waste to be used
- b) Decomposition and
- c) Outcome preparation for use

• Preparation of Waste to be Used

In this case, four trenches are dug where the refuse will pass through before finally composted. The waste is collected and sorted out. The incombustible materials are beaten flat and arranged at the bottom of the first trench. Other waste materials (the combustible) are laid on top of it and covered with a very thin layer of soil. The waste will spend 3 - 4weeks in this first trench before turning into the second trench. As this is being done, there will be once or twice tuning of the waste while at the trench.

• **Decomposition**

The remaining three trenches is for the decomposition process. The wastes are turned from the first to the second and to the third trench in 3 weeks interval covering the period of 9 weeks. During this period, a lot of fermentation takes place due to rapid temperature acting on the waste. As a result, eggs, flies worms and maggots that developed in the wastes are destroyed.

• **Waste Preparation for Use**

By the last stage of turning, the materials would have been broken down completely into black manure. In order to prepare the waste for use, it may require grinding, blending, bagging for direct marketing of the end product which can be used for agricultural purposes, land filling and reclamation purposes.

Advantages

- a) It can be used to dispose various types of wastes
- b) Requires less land for operation
- c) It is economical
- d) Income are raised from the sale of the end product
- e) It can be used for land filling and reclamation purposed

Disadvantages

- a) Emission of offensive odour
- b) Attraction of rodents and flies infestation
- c) It requires time and skill for operation

32 Non–Conventional Method of Final Disposal of Solid Waste

- 1) Incineration
- 2) Pulverization
- 3) Pyrolysis

3.2.1 Incineration

This is an advanced method of solid wastes disposal. There are three basic types of incinerator namely bar incinerator, bar less incinerator and beehive incinerator. Among these three, the commonly used in developing nations like Nigeria is the bar incinerator.



Fig 2: Bar Incinerator (Culled from Indiamart.com)

Features of the Bar Incinerator

- **Storage Bin** - This is where wastes discharged from collection vehicles are stored.
- **Batching Crane** - Used to direct wastes through the stokers to the combustion chamber.
- **Stokers** - light are passed through the stokers into the combustion chamber, where wastes are ignited for combustion.
- **Combustion Chamber** - This is where wastes are consumed at a temperature not exceeding 900^{0c}
- **Thermal Volume Reduction System** - used to dry the moisture content of the wastes for effective combustion.

- **Reduce Hopper** - This is where the unborn and partially consumed materials fall after combustion.
- **Ashes Collector Chamber** - The receptor of all the burnt ashes.
- **Ash Cleaning Fan** - Used to remove burnt ashes from the ashes collector to landfill site for final disposal of the ashes.
- **Overhanging Roof** - Made to prevent rainfall inside the incinerator during raining periods.

Advantages

- i) It requires less land for operation.
- ii) Many kinds of refuse can be burnt, both combustible and incombustible.
- iii) There is provision for long term operation of the system.
- iv) The ashes generated from combustion can be used for some other purposes.
- v) There is no attraction of rodents and flies,
- vi) It is not affected by climate and weather,
- vii) It controls odour nuisance.

Disadvantages

- i) In case of malfunctioning, there will be pollution of the atmospheric air.
- ii) The ashes if not properly handled may lead to eyes and throat irritation and infection to the respiratory tract,
- iii) It is very expensive to operate and maintain
- iv) It requires skilled management.

3.2.2 Pulverization

This is a method used in advanced countries. In this case, solid wastes are heated up to dry it. The incombustible is sorted out and separated from the combustible. The combustible is therefore, grinded by the grinder.

Advantages

- a) Reduction of large volume of waste to smaller size
- b) It can be used for land filling and fertilizer
- c) There are no emission of offensive

odour

Disadvantages

- a) It is very expensive to operate and maintain
- b) The by-product if not well handled may result to eye and throat irritation
- c) It is technological intensive

3.2.3 Pyrolysis

This method is mainly practiced in the developed countries. It involves the combustion wastes in the absence of oxygen for conversion into gases and other chemical processes and hydrolysis. It is a highly expensive and technological intensive method of dry waste final disposal required for ecstatic wastes disposal.

SELF-ASSESSMENT EXERCISE(S)

- 1) Identify the advantages and disadvantages of the following:
 - i) Incineration.
 - ii) Pulverization.
- 2) Discuss the Pyrolysis method of final disposal of refuse.

4.0 CONCLUSION

This unit has x-rayed various methods for final disposal of solid waste. Some of the methods are conventional in the sense that they are the common methods that are being adopted for final disposal of solid waste. Some are non-conventional because they are not ordinarily in use or they are not in common place for use. The fact that the methods are conventional does not mean that they are the best method of final disposal. This could be revealed from their advantages and disadvantages which were highlighted along with the description of each method. The knowledge you have acquired from this unit will help you to make appropriate choice and advocacy on the best method to be adopted in your environment for final disposal of solid waste.

5.0 SUMMARY

You have been exposed to the knowledge of various methods of solid waste disposal in this unit. You are expected to have learnt the conventional methods and the non-conventional methods, their features and processes involved in each method as well as the advantages and disadvantages of each method.

6.0 TUTOR/MARKED ASSESSMENT

1. Describe the sanitary landfill method of final disposal of solid waste, identifying the advantages and disadvantages
2. Discuss the process by which organic matters are broken down by action of bacteria in composting method of final disposal of solid waste.
3. With a labelled diagram, describe the structure of the incinerator

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UNIT 3 WET REFUSE OR LIQUID WASTE DISPOSAL

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Definition of Liquid Waste and Methods of Sewage Disposal
 - 3.2 Methods of Sewage Disposals
 - 3.2.1 Water Closet System
 - 3.2.2 Pit Latrine
 - 3.2.3 Ventilated Improved Pit Latrine (VIP)
 - 3.2.4 Aqua Privy Latrine
 - 3.2.5 Mobile Chemical Closet Systems
 - 3.3 Central Sewage Treatment
 - 3.3.1 Primary Sewage Treatment
 - 3.3.2 Secondary Sewage Treatment
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor/Marked Assessment
- 7.0 References/Further Reading

1.0 INTRODUCTION

In the olden days, so many methods of sewage disposal have been adopted such as the bush method, bucket system, poor flush and so on. These methods have their great disadvantages and have resulted to spread of faeca-oral and other communicable diseases. In this modern time, greater attention has been placed on public health and approvals have been given to some methods of liquid waste disposal. This unit will give the definition of liquid waste and describe the types of liquid waste disposal systems that are being adopted for disposal of liquid waste. The advantages and disadvantages of each system will also be highlighted. The unit will equally discuss the central sewage treatment.

2.0 OBJECTIVES

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

- 1. Define Liquid Waste.
- 2. Describe the Water Closet System.
- 3. Distinguish between Pit Latrine and ventilated Improved Pit Latrine.
- 4. Describe Aqua Privy Latrine and the Mobile Chemical Systems.

3.0 MAIN CONTENT

3.1 Definition of Liquid Waste and Water Closet System

Wet refuse is divided into two namely (1) Sullage and (2) Sewage

- **Sullage** - This is the combination of water from the laundry, kitchen and waste water from bathroom.
- **Sewage** - This is the combination of waste water and faeces or excretion. Sewage disposal poses a major concern to public health because it contains living organisms' particularly very large numbers of bacteria, viruses and protozoa that could cause serious health problems if not well managed.

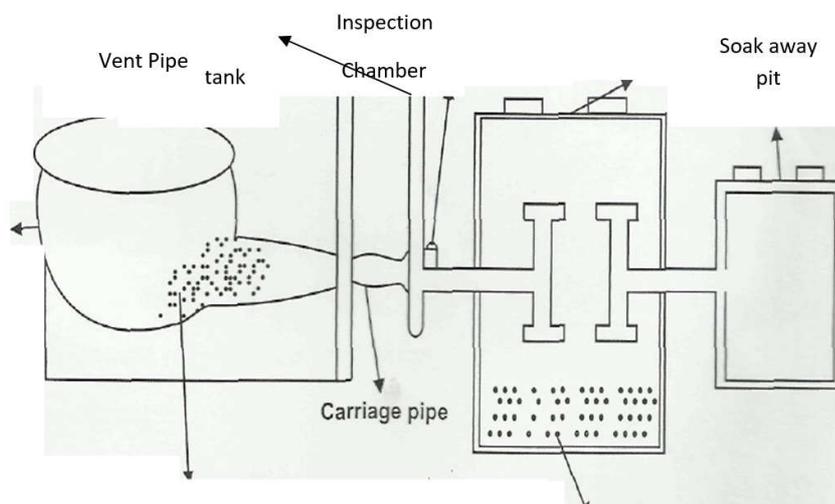
3.2 Methods of Sewage Disposal

In the olden days, so many methods have been used for the disposal of sewage such as bucket system, bush method, etc. This resulted to occasional spread of faeca-oral or other communicable diseases. But in the modern times, when greater attention has been placed on public health, the approved systems and methods of disposal are highly used.

These include:

- Water closet system
- The ventilated improved pit system (V.I.P. Latrine)
- The aqua privy system
- The mobile chemical closet system
- Pit latrines

3.2.1 Fig 3: Water Closet System



This is one of the most popular and acceptable methods of excreta disposal. It requires water to function effectively since all liquid waste and faecal matter are removed by gravity assisted by this flow of water. It consists of the following major parts:

- a) water closet basin seat
 - b) vent pipe
 - c) inspection chamber
 - d) septic tank
 - e) soak away pit
- **Water closet basin seat** - This is the place where defecation takes place. The basin contains a measurable level of water, known as water seal. The purpose of the water seal is to prevent emanation of foul smell from the basin after use and to prevent in and out movement of rodents, reptiles and insects. The basin has to be well fitted on the ground to avoid any form of accident or breakage.
 - **Vents Pipe** - The vent pipe is fitted vertically on a platform of the carriage pipe. It is meant to trap offensive or foul odour up surging back from the septic tank. The top of the vent is fitted with wire mesh to prevent flies from entering in and out of the pipe.
 - **Inspection Chamber** - This is fitted very close to the vent pipe base to enable inspection of the inside of conveying pipe for evidence of blockage at any period of operation of the system.
 - **Septic tank** - This is a pit dogged and made watertight to prevent see page of sewage into sub-soil and to avoid pollution of underground water. The purpose of this tank is to retain crude sewage until the soluble solids liquefy and the insoluble solids precipitate as sludge.
 - **Soak away pit** - This is a perforated pit that collects soluble or liquefied sewage when the septic tank is filled up. Through the perforated areas in the pit, the liquefied gets absorbed in the soil.

Advantages

- a) It can be used in any rural or urban setting
- b) It is one of the best method of excreta disposal
- c) It prevents foul odour and faecal-oral diseases
- d) It can be used for a very long time

Disadvantages

- a) It is very expensive compared to the pit latrine
- b) It requires a lot of water for effective operation

- c) If not properly maintained, could lead to blockage of pipes and constitute a potential danger to human health.

3.2.2 Pit Latrine and Ventilated Improved Pit Latrine (V.I.P.)

Pit Latrine

Pit latrine is one of the oldest methods of sewage disposal. It is supposed to have been replaced by the ventilated improved pit latrine but probably, due to lack of understanding many people especially in the rural communities still make use of this method. In this method, a pit of about 3 meters is dug. The pit is being covered with a slab. In the centre of the slab, there is an opening or orifice for defecation. A superstructure is built over it with roof to provide shelter and protect the latrine from rain. The orifice is supposed to have a fitted cover to prevent odour, flies and other rodents and vermin from getting into the pit.



Fig 4: Pit Latrine

Advantages

- a) It is cheap to construct.
- b) It is durable especially if built for fewer populations.

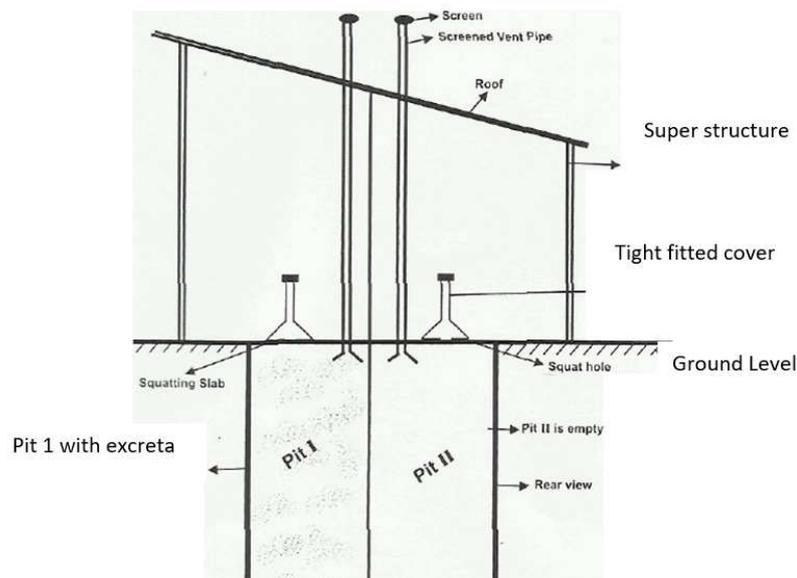
- c) It is easy to maintain.

Disadvantages

- a) It can contaminate ground water
- b) Once the pit fills up, it cannot be used again
- c) It can collapse
- d) Human beings and animals can fall into the pit if the orifice is not properly covered.
- e) It emits odour nuisance
- f) If not well covered, it could breed flies and harbour rodents and vermin.
- g) In case where it is not well maintained it creates unsightliness.

3.2.3 Ventilated Improved Pit Latrine (V.I.P. Latrine)

Fig 5: Diagram of the Ventilated Improved Pit Latrine (V.I.P. Latrine)



This is a modification of the conventional pit latrine. Sanitary Engineer designed it to ensure a decent and safe disposal of human excreta, to improve individual and community health and to prevent the transmission of faeca-oral diseases that cause death.

Basic Principles of V.I.P Latrine

- **Odour control** – It controls odour by the action of the screened vent pipe which sucks out foul air as fresh air enters from the top. When the foul air produced from breakdown of faecal material in the pit is heated by the direct sunlight, the heat rises to the top of the pipe from where it goes out. Another fresh air enters the superstructure through the squat hole to continue the cycle making the latrine an odour free.
- **Fly control** - The odours from the vent pipe attract flies but because of the fly screen that covers the end of the vent pipe, flies cannot enter the pit through the vent pipe. Flies cannot equally enter the pit through the squat hole and lay eggs in the pit. In case where flies finds its way into the pit, they will find it difficult flying out. This is because the vent pipe supplies light to the pit, this light will attract the flies but when they want to fly out through the pipe, they get trapped by the fly screen.
- **Storage and breakdown of excreta** - The pit stores the human excreta which are bacteriological broken down into disease free material. This makes the liquid portion of the excreta go into the soil and the solid part will undergo biological decomposition turning it into black residue and gaseous compounds. The black residue remains in the pit while the gaseous compound escapes through the vent pipe.
- **Reuse of pits** - The pit is supposed to be lined so that when it fills, the black residue can be removed and used as manure living the pit free for subsequent use. This is done after 18 months when the excreta or black residue have been made harmless in the pit. The V.I.P latrine is made to have two pits in one in order to make for an alternating pit (when one is filled up you shift to the other allowing the filled one to decompose). The first pit is sealed off when it is full and the second pit put in use.

Advantages

- i. It is structurally safe and poses no risk to users.
- ii. It provides a safe method of human excreta disposal and provides barrier to faeca-borne infections.
- iii. Easy to construct and maintain
- iv. It is very durable

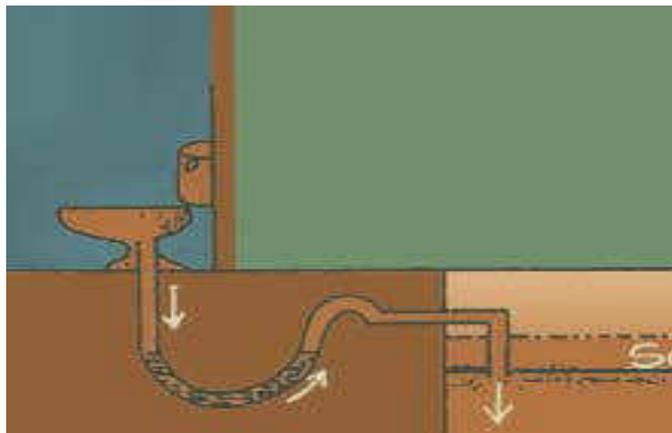
- v. All type of cleansing materials can be used
- vi. Suitable for villages and relatively cheap.
- vii. It eliminates odour, flies and mosquito nuisances

Disadvantages

- a) It can pollute groundwater if not well sited and well-constructed
- b) When one compartment is full it requires money for dislodging

3.2.4 Aqua Privy Latrine

This type of latrine requires water to function effectively on a daily basis. In this case, a pit is dug and it is being covered with slab. The latrine is made in such a way that it will require water for flushing. The pit is made water tight preferably deep depending on the number of users. When the pit is filled, the latrine has to be abandoned for some time or the slab removed and evacuated.



Advantages

- a) It is one of the best methods of excreta disposal.
- b) It requires little water when compared with the water closet.
- c) It could be used in both rural and urban areas
- d) The by-product is used as manure
- e) It prevent foul odour and flies breeding
- f) It is durable

Disadvantages

- a) It requires water for functioning
- b) It is expensive when compared to pit latrine

3.2.5 Mobile Chemical Closet System

This is an effective highly sophisticated system that operates with a deodorizing, liquefying or sterilizing liquid chemical. It is in use mostly inside aircraft, densely populated market, ships, mountainous cities and riverine areas where it may not be easy to use any other methods of excreta disposal. The closets are usually constructed of strong plastic or fibre glass and it is supported in rectangular plastic. The chemical has the capacity of absorbing liquid from the excreta, dries the waste and turn it into powder. Before the disposal of the powdered waste, the local public health authority must be notified. It can be disposed into water sources, drainage, canal or other disposal points.



Fig 7: Mobile Chemical Closet System



Fig 8: Mobile Chemical Closet Basin

Advantages

- a) It is the best for areas where there is no land space
- b) It does not allow foul odour of insect breeding
- c) It is very hygienic

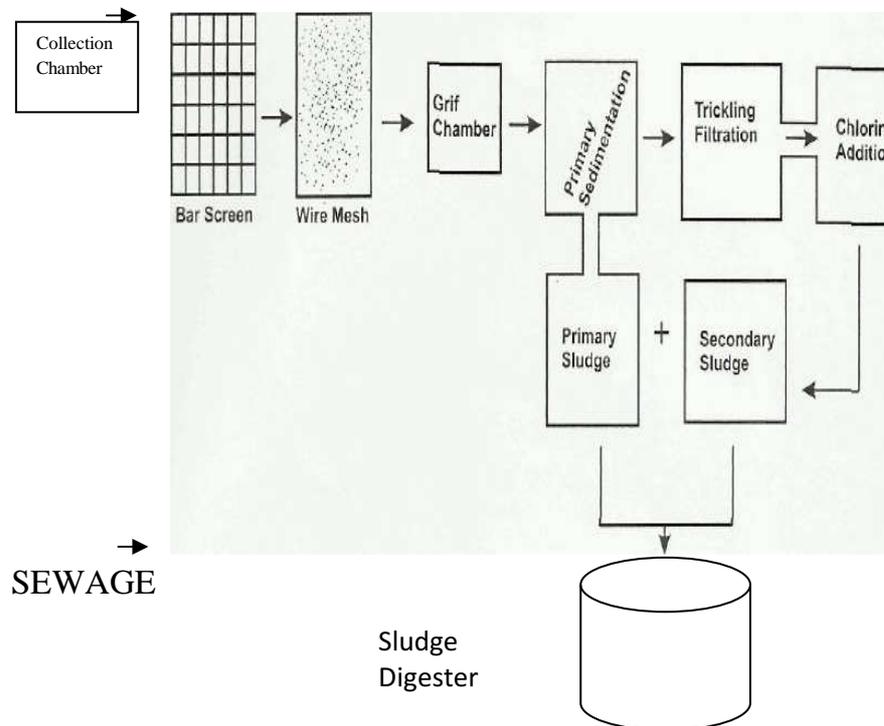
Disadvantages

- a) It is very expensive to operate as the chemicals to be used are very costly and can only be afforded by government or rich individuals.
- b) It requires high level technology
- c) It does not hold bulky excreta

3.3 Central Sewage Treatment

Primary Sewage Treatment

Fig 9: CENTRAL SEWAGE TREATMENT



There are so many levels and process in sewage treatment. These processes comprise of biological treatment and chemical treatment which ever type must operate under primary and secondary level treatment.

3.3.1 Primary Treatment

The process include:

- 1) **Screening of Sewage** - This is physically done by removing the coarse particles, large floating objects such as rags, sticks, paper, leaves etc. that and can damage any component of the treatment plant.
- 2) The materials collected by these screens are

removed for drying and incineration after which the screens are re-fixed back for operation.

- 3) **Introduction of Communitor** - The communitor is introduced immediately after drying. The function is to grind all remaining coarse materials into small pieces which are left with the effluent.
- 4) After the introduction of the communitor, the effluent flows into the frit chamber where it is detained for some minutes. This is to allow heavy particles to settle out. Then lighter materials which take time to settle, flows out from the grit chamber into the primary sedimentation tank.
- 5) As the sewage effluent flow inside with speed, it is slowed down to allow most of the suspended solids to settle out by gravity.
6. The sewage effluent is retained at this chamber for between 2-4 hours. This results in removal of about 50 - 55% of suspended solids.
7. The solid that settles out are called primary sludge which is removed to the sludge digester to await additional sludge after the primary treatment process is completed.

3.3.2 Secondary Treatment

The main objective of the secondary treatment is to further reduce the amount of pollutants in the sewage. This can be done in three basic forms namely the trickling filtration, activated sludge and the sludge treatment. The major functions of the above form are:

1. To filter the effluent from the primary sedimentation tank.
2. To apply biological treatment and chemical treatment to the effluence. This include introduction of lime into the effluent to induce the action of fungi, algae, protozoa, worms which in turn absorbs and consummate the raw effluent. After the actions of these organisms, the effluents are treated with chlorine to obtain a very high level of purification.
3. Finally, the effluent can then safely be discharged into the following means;
 - a) It can be dumped into the sea or river
 - b) It can be dried in an open air
 - c) It can be fermented to obtain methane gas for commercial use.
 - d) The sediment part in primary treatment (primary sludge) can be used as manure.

SELF-ASSESSMENT EXERCISE(S)

1. With a well labelled diagram, describe the water closet system
2. Describe the basic principles of V.I.P Latrine
3. Identify the advantages and the disadvantages of the following:
 - i. Pit latrine
 - ii. Mobile Chemical Closet System

4.0 CONCLUSION

This unit has classified liquid waste into sewage and sullage wastes and have shown that the most obnoxious and the major source of infection is the sewage. The unit therefore dwelt on the discussion of sewage. It is expected that the knowledge you have acquired from this unit will help you understand the danger of indiscriminate sewage disposal. It will also help you in adopting the best method and advocating for the best method of sewage disposal system in your community. The knowledge will equally guide you in creating awareness on the proper measures to be adopted in channelling sewage to the central sewage treatment centre.

5.0 SUMMARY

In this unit, liquid waste was classified into sewage and sullage and the definitions were given. The unit described the different types of approved sewage disposal systems and indicated their advantages and disadvantages. In the unit also, the central waste management system was discussed.

6.0 TUTOR/MARKED ASSESSMENT

1. With a labelled diagram, describe the primary sewage treatment.
2. Identify the advantages and disadvantages of Mobile Chemical Closet system.
3. Why is the V.I.P. Latrine preferred to Pit Latrine?

7.0 REFERENCES/FURTHER READING

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MODULE 3 ENVIRONMENTAL POLLUTION MODULE INTRODUCTION

The increase in technological development, intensity of our daily activities and unplanned urbanization has resulted to the release of poisonous substances in form of chemicals, gaseous or solid into the environment. These have resulted to the pollution of the atmospheric air, water, soil and food. This module will discuss environmental pollution and measures for controlling environmental pollution. It will also look into the different types of environmental pollution, with emphasis on air, water, noise, soil, and food pollution.

Unit 1	Concept of Environmental Pollution and Air Pollution
Unit 2	Water Pollution
Unit 3	Noise Pollutions
Unit 4	Soil Pollution
Unit 5	Food Hygiene and Food Pollution

UNIT 1 CONCEPT OF ENVIRONMENTAL POLLUTION AND AIR POLLUTION

CONTENTS

1.0	Introduction
2.0	Objectives
3.0	Main Content
3.1	Concept Environmental Pollution
3.2	Pollutants
3.3	Control of Environmental Pollution
3.4	Agencies for Environmental Pollution Control in Nigeria
3.5	Air Pollution
3.5.1	Types and Sources of Air Pollution
3.5.2	Effects of Air Pollution
4.0	Conclusion
5.0	Summary
6.0	Tutor/Marked Assessment
7.0	References/Further Reading

1.0 INTRODUCTION

Environmental Pollution has constituted one of the major threats to the ecosystem. There are a lot of automobile emissions and power plants emissions arising from the proliferation of industries and urbanization in our environment in the present decade. These have resulted to low quality of air and have increased the number of diseases to the

respiratory tract and death rate due to respiratory tract infections. This unit is set to define environmental pollution. The unit will also be looking into the measures for controlling environmental pollution and agencies for pollution control in Nigeria. The unit will also be focusing on air pollution, the definitions, types and sources and the effects of air pollution to the inhabitants of the environment.

2.0 OBJECTIVES

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

1. Define environmental pollution.
2. Identify measures for controlling pollution.
3. Identify the agencies for pollution control in Nigeria.
4. Define air pollution.
5. State the types and sources of air pollution.
6. Discuss the effects of air pollution.

3.0 MAIN CONTENT

3.1 Concept of Environmental Pollution

Because of the increase in technological development and intensity of our daily activities, in addition to the population pressure in terms of urbanization, the ecological system begins to suffer stress. Environmental pollution is the contamination of air, water or food in such a manner as to cause real or potential harm to human health or well-being or damage to non-human nature without justification. Environmental pollution could also be defined as the introduction by man into the environment of substances or energy liable to cause hazards to human health, harm to living resources, and ecological systems, damage to structures or interference with the legitimate use of the environment. From the above definitions, some basic facts can be deduced.

1. That pollution is caused by substances
2. That man is the major cause of sources of pollution.
3. That pollution has effects on man, resources and ecological systems.
4. Environmental pollution could be man-made pollution it could also be natural pollution. Man-made is caused by human activities while natural pollution is caused by natural sources.

3.2 Pollutants

These are substances causing damage to living and non-living things in the environment. Some chemical elements such as Carbon, Nitrogen, Oxygen, Sodium, Manganese, Iron, Bromide, Zinc, Calcium, and Magnesium, copper, potassium and so on when they occur in single or in combined form may be essential to some substances in the environment and they may be toxic to the environment at a certain level. For instance, when they exceed their ambient level or Carbon and Nitrogen are essential to plant but they are toxic to animals particularly when carbon combines with Oxygen to form Carbon-monoxide.

Secondly, the effects of pollutants on the environment could depend on formulation of the substances or the concentration e.g., the organic combination of Mercury particularly methyl mercury pose a greater risk or hazard than its inorganic salt.

1.3 Control of Environmental Pollution

- a) **Site Selection and Zoning** - planning of industrial estates, residential should be done, highways,
- b) **Process change or Equipment Modification** - e.g. the use of tall chimneys to spread pollution and reduce concentration, wet process of cement manufacturing instead of dry process etc.
- c) **Fuel Selection and utilization** - e.g. Diesel fuel which does not produce chemical pollutions, may replace gasoline which produces pollutants like sulphur dioxide, increasing the burning efficiency of fuel to ensure complete combustion and avoid carbon-monoxide.
- d) **Legislation** - Enactment of laws that will help regulate the generation of poisonous substances in the environment. Advocating for some regulatory agencies like the Federal Environmental Protection Agency (FEPA), Clean Nigeria Associates (CAN) etc.
- e) **Health Education** - The masses should be educated on the effect of environmental pollution.
- f) Continues research in issues related to environmental pollution.
- g) **Involving members of the public** – Members of the public should be involved in actions or programme regarding environmental pollution.
- h) **Sensitizing and stimulating the workers of**

Environmental Sanitation or Task Force- this is a body or group established by the government to ensure a clean, pollution free and healthy environment. They usually operate at the Local Government level though they are linked to the state and the federal levels. They take directives from the chief executive at the federal level through the General Manager at the state level and then the controller at the local level. They generate their income locally and gets subvention from the Federal Government.

3.4 Agencies for Environmental Pollution Control

1. Federal Environmental Protection Agency (FEPA)
2. Delta State Environmental Protection Agency (DELSEPA)
3. United Nations Environmental Programme (UNEP)
4. Non-Governmental Organizations (NGOs):
 - i. Nigerian Conservation Foundation (NCF)
 - ii. Foundation for Environmental Development and Education of Nigeria (FEDEN)
 - iii. Nigerian Environmental Society (NES)
 - iv. Nigerian Environment Action and Study Team (NEAST)
 - v. Friends of the Environment (FOTE)
 - vi. Nigerian Environmental link (NEL)
 - vii. Ecological Society of Nigeria (ECOSON)
 - viii. Nigerian Environmental Health Officers Association (NEHOA)

3.5 Air Pollution

Air pollution is the presence in the out air atmosphere of substances or contaminants which emanates mostly from anthropogenic activities in quantities and duration to cause any discomfort to substantial number of inhabitants of a locality or which are injurious to public health, plant or animal life or property or which interferes with the reasonable or comfortable enjoyment of life in an area.



Fig 10: Industrial Plant Pollution

3.5.1 Types and Source of Air Pollution

- a) Nitrogen oxides which emanate from natural and anthropogenic activities such as burning, lighting, microbial activities, biological processes, high temperature, combustion, power station etc.
- b) Sulphur Dioxide which results from domestic fuel, diesel etc.
- c) Carbon monoxide - From combustion of fossil fuels or organic materials, motor vehicle etc.
- d) Chlorofluorocarbons - This arise from refrigerator manufacturing process, aerosol spray cans, air conditioners, plastic, foams and solvents.
- e) Particulate matter such as dust, fume, mist, smoke, spray and lead. These are being generated from motor vehicle using leaded petrol, demolition of structures, excavation of soil, wood materials, etc.
- f) Asbestos - This emanate from asbestos mining, construction, refining, fabrication, demolition, remodelling and replacement of pipes and furnaces.
- g) Mercury - From Chloralkali manufacturing, battery manufacturing and solid waste incineration.
- h) Hydrogen Sulphide - From craft paper manufacturing, oil refining and pipeline transformation.
- i) Benzene - From pharmaceutical manufacturing petrochemical manufacturing, industrial solvents.
- j) Fluoride - From primary aluminium smelting and phosphate fertilizer manufacturing,

3.5.2 Effects of Air Pollution

Effects on man

1. It aggravates respiratory and cardiovascular diseases
2. Causes chronic pulmonary fibrosis especially the gaseous pollutants
3. Causes bronchitis in 2 -3 years old children
4. If concentrated can cause kidney inflammation
5. Impairs visibility at very high concentration causing even vehicle accidents and sever loss to live and property.
6. Impairs mental functions in case of carbon monoxide exposure.
7. Exposure to carbon dioxide (CO₂) at a very high level may cause unconsciousness and death.
8. Causes headaches, nausea, and loss of coordination.
9. Long exposure to volatile organic compounds can lead to liver problem.
10. Some dangerous substances such as lead can cause impaired growth of bone and nervous systems in children and
11. Causes congenital deficits in children
12. In adult, it can cause damage to the brain, kidney, liver and reproductive system.
13. Dust and other poisonous substances can lead to asthma and other cardiovascular diseases.
14. Some may be carcinogenic; it can penetrate deeply into the lungs.

Effects on Animals

Air pollution affects animals just the way it affects man. The damage it causes to animals depends on the animal's size and respiratory rate. Many animals die from inhaling toxic gas (even at a lower intake than will kill man). An additional hazard to animals is chronic poisoning from ingesting forage contaminated by particulate pollutants such as heavy metals organic, lead etc.

Effects on Vegetation or Plant

Air pollution affects vegetation in three ways namely:

- a) Necrosis- collapse of the leaf tissue
- b) Chlorosis - bleaching or other colour changes
- c) Alterations in growth.

It is important to note that the types of injuries caused by various pollutants to plants differ from one another.

Effects on Materials

The most common effect of air pollution on materials is the soiling of building surfaces, clothing and other articles. The soiling results partly from deposition of smoke on surfaces overtime and partly from Acidic precipitation and pollutants like sulphur dioxide. Fabrics and dye also bleach as a result of particulate matter such as dust. Nitric acid causes corrosion on metal surfaces.

SELF-ASSESSMENT EXERCISE

1. Define the following terms:
 - (i) Environmental Pollution
 - (ii) Pollutants
2. Describe any four measures for controlling environmental pollution.
3. Mention any six NGOs in-charge of environmental pollution control in Nigeria.

4.0 CONCLUSION

This unit has acquainted you with the knowledge of the concept of environmental pollution. It has exposed you to the knowledge of the meaning of air pollution. The unit has also revealed that air pollution is mostly caused by anthropogenic activities and it is likely to affect man, animals, plants and properties or materials. The knowledge you have gained in this unit will help you to avoid getting involved in activities that could pollute the environment or lead to air pollution. It will equally help you to know how to protect yourself, your properties and your entire environment from getting exposed to polluted air.

5.0 SUMMARY

This unit focused on the definition of environmental pollution, measures for controlling pollution and the agencies for controlling environmental pollution in Nigeria. The unit focussed also on air pollution, types and sources of air pollution. It equally described the effects of air pollution on man and other inhabitants of the environment.

6.0 TUTOR/MARKED ASSESSMENT

1. Discuss the effects of air pollution on the following:
2. Man

3. Vegetations and plants.
4. Identify any five sources of air pollution.

7.0 REFERENCES/FURTHER READING

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UNIT 2 WATER POLLUTION

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Sources of Water
 - 3.1.1 Assurance of Safe
 - 3.1.2 Use of Water
 - 3.1.3 Principles of Safe Water
 - 3.2 Sources of Water Pollution
 - 3.2.1 Waste from Natural Sources
 - 3.2.2 Agricultural Waste
 - 3.2.3 Domestic Waste
 - 3.2.4 Commercial or Industrial Waste
 - 3.3 Water Purification
 - 3.3.1 Methods of Water Purifications at Home
 - 3.3.2 Objectives of Water Purification
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- 5.0 Summary
- 6.0 Tutor/Marked Assessment
- 7.0 References/Further Reading

1.0 INTRODUCTION

Water is one of the most important resources required by man and other living organisms. When water is polluted, it affects not only man but other living organisms. This unit will discuss the sources of water and what determines safe water. It will highlight the principles of safe water, sources of water pollution and water purification/treatment methods at home.

2.0 OBJECTIVES

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

- Identify the sources of water and the assurance of safe water
- State the principles of safe water
- Enumerate the sources of water pollution
- Discuss water purification/water treatment methods

3.0 MAIN CONTENT

3.1 Sources of Water

Water is essential to life because it is the major component of the body tissue. It also serves as solvents. It is one of the major components of the blood. However, water is like a doubled edged sword. It can be a blessing and a hazard. If polluted water is introduced to the body it is hazardous. A water supply system has been identified as a domiciliary water supply, in which water is supplied for part of a larger system of water storage and water distribution. Such a system is slow by public water system. On the other hand, a locality without water is brought to the homes from streams, river, carnal and other similar sources. Water is usually served by private owned or individually. However, all water supplies have its origin in rainfall. We have:

- Surface water which include lakes, ponds, stream etc.
- Ground water which include spring, borehole and deep wells.

3.1.1 Assurance of Safe Water

1. By the mechanical and physical protection of the sources of surface water e.g. stream, lake, etc
2. Co-agulation and sedimentation by addition of alum, which is a chemical co-agulate (aluminium sulphate).
3. Filtration and straining with gauze or mechanized screen or tunnel sand bed. This process removes a large particles but Cyclops bust cannot be removed.
4. Use of Chlorination which is equal to chemical disinfection. (Addition of chlorine which kills micro organisms.)
5. Addition of fluoride – This helps in protecting dental carriers.
6. Proper observation of personal hygiene since some of the organisms needs human begins for some aspect of their development e.g., guinea worm.

3.1.2 Uses of Water

Water is social amenity used to improve quality of health and living. Safe water in sufficient quantity is one of the primary necessity of existence as well as a necessity for social, economic and industrial existence of people

1. For body function
2. Domestic services
3. Social recreations
4. Transportation
5. Agricultural purposes

3.1.3 Principles of Safe Water

1. Physical qualities
 - a) Freedom from chemical and biological hazards.
 - b) Adequate quantity, which has been estimated at 25-50 litres per person, per day
 - c) Has a ph of 7.0.
 - d) It is colourless.
 - e) It is turbid.
2. Social quality
 - a) It should be palatable and acceptable in taste.
 - b) It is odourless.
 - c) Water is soft (Soap leathers easily)
3. Biological quality
 - a) Absence of algae and protozoa
4. Bacteriological quality
 - a) Absence of coliform organisms.
 - b) Absence of E-coli (Escherichia coli)
 - c) Absence of forceful streptococci organ

3.2 Sources of Water Pollution

Water pollution can be defined as the introduction of substances into water levels which at the end may cause a deleterious or harmful effect on human health, or on aquatic creatures, or on structures and materials. Surface water is more liable to be pollution because of its water shade. Ground water can be polluted by septic tank and by oil fields (Strong solution of salt in water). There are so many sources of water pollution. Almost every human activity results to water pollution but the main sources through which water is being polluted are:

1. Waste from natural sources
2. Agricultural waste
3. Domestic and municipal sewage
4. Commercial or industrial wastes

3.2.1 Waste from Natural Sources

These include dead organic matters arising from plants (leaves, branches, twigs etc) and animals (molluscs, fishes, rabbits, rats, crustacean etc) that fall or die inside water source and decay in them. They are natural impurities and the decaying plant materials give rise to fungal micro-organisms while the decaying animals yield bacterial. These micro-organisms in-turn pollute the water sources.

3.2.2 Agricultural Wastes

Eroded materials from farmlands, plant nutrients, vegetation, inorganic salts and minerals resulting from irrigation, herbicides and pesticides give rise to water pollution. Presently, farmers use fertilizers to improve crop growth and yield. Fertilizers contain nitrogen and phosphorus, when they are not properly used and are dumped in every part of the farms; they are leached off from the land into rivers and lakes to cause excessive nutrient enrichment in water leading to propagation of weeds and rich green algae in water bodies.

3.2.3 Domestic Sewage

These are human faeces and urine plus sullage. Domestic sewage has an odour and is hazardous in content because of the pathogenic organisms it contains. This sewage when emptied into a water body causes pollution to the water. Because sewage and sullage contain large floating or suspended solids like faeces, rags, grease, vegetable peels and so on, they pollute water bodies in three ways,

- i. It adds organic matter, organic forms of pathogen and phosphorus to water which stimulates the growth of organisms which in turn uses up the available oxygen in water,
- ii. It adds intestinal bacteria (coliform) along with other pathogens to water.
- iii. It can add hard detergents such as Alkyl benzene sulphonate (ABS) which causes rivers to foam. This situation fastens the deterioration of water.

3.2.4 Commercial or Industrial Wastes

These wastes contain large quantities of raw materials, processing chemicals and by-products such as solvents, detergents, cyanide, heavy metals, minerals, organic acids, nitrogenous substances, fats, salts, bleaching agent, dyes, pigments, sulphide etc.



Fig 11: Commercial or Industrial Wastes

3.3 Water Purification/Treatment at Home

Water from sources such as pond, rain water, shallow well, stream and river may require purification to make it safe for drinking. This is because water from the above sources could be polluted by pathogenic organisms.

3.3.1 Method of Water Purification at Home

There are many simple ways of treating water for drinking at home. These:

- a) **Boiling:** the easiest and cheapest way of treating water is by boiling. It involves boiling water and allowing it to cool before drinking. For water drawn from well, it should be filtered after cooling before drinking.
- b) **Filtration:** This is also one of the effective methods of purifying water. In this case, the correct multimedia filters is required to give the best by removing all unnecessary elements from the water. The method uses chemical and physical absorption processes to purify water and it removes both large and small compounds from the water. Filtration is good because it does not remove all the mineral salts from the water after filtering the water. There are simple filtration devices that can be found in our local homes such as sand filter, simple domestic cloth filter, and thick linen filter. The danger of these types of filter devices is that they need thorough cleanliness otherwise, they turn to become source of pollution to the water-
- c) **Distillation:** Distillation utilized heat to collect pure water in the form of vapour. The rationale behind the effectiveness of this method is that water has a lower boiling point than other disease-causing elements found in water-the water is allowed to heat to boiling point. The vapour from the boiling water is channelled into a container and allowed to cool. The cooled vapour becomes the safe drinking water. The advantage is that the method removes bacteria germs, salts and other heavy metals such as arsenic, lead, and mercury from the water and it is simple to practice. The disadvantages are that the method is a slow process of water purification and it requires heat that will continue until the whole water forms vapour. This is likely to consume gas and as such, it is costly
- d) **Chlorination:** Chlorination is another simple way of purify water. Chlorine is a strong chemical that is very effective in water purification. It kills parasites, germs, and other organisms that cause infection in water. Liquid or tablet chlorine could be used and both are cheap and effective. The only problem with chlorine

treatment is that people who have thyroid problems are not advised to treat their water with chlorine. Chlorine tablet is better used in heated water than cold since it dissolves better in hot water.

- e) **Sedimentation:** this involves the addition of aluminium sulphate to water flocculate all suspended matter in the water. It allows after particles to settle fast leaving the water very clean and safe for drinking.
- f) **PH correction:** In this case, lime is introduced into a filtered water to minimize corrosion in the water liquid iodine and iodine tablet. To purify water, little amount of liquid iodine and iodine tablet could be used. However, it is advisable to use this method in filtering water that is used for a very short term because iodine is a chemical substance that could become harmful to the body if the water is kept for a long time.
- g) **Non-chemical stabilized oxygen:** Another easiest means of purifying water is to add drops of stabilized oxygen in the water. It is a natural antibiotic that can be bought from the market and the instructions for use are contained in the tablet.
- h) **Solar Disinfection:** This is a simple method that purifies water. It involves heating the polluted water under the sun. Get a bottle and fill it up to three quarters. Shake the water for about 20-30 seconds before filling it up with water. Close the bottle tightly and put in the direct sun's rays for minimum of 6-8 hours before drinking.

3.3.2 Objectives of Water Purification

1. To remove facial matter present in the water
2. To restore the taste of the water
3. To prevent fluorosis of the teeth and dental caries
4. To remove unpleasant odour from the water
5. To destroy pathogenic organisms present in the water
6. To remove water turbidity
7. To make the water fit to be stored for a long time.

SELF-ASSESSMENT EXERCISE

1. Discuss the principles of safe water.
2. List and discuss the sources of water pollution.

4.0 CONCLUSION

Water has been described in this unit as essential to life and as a social amenity used to improve quality of health and living. You have also learnt from this unit that water should be free from pollution and the

sources of water pollution have been highlighted. Forms of water, requiring purification and the home methods for water treatment were equally elucidated. It becomes important that you practice water treatment at home to avoid intake of polluted water.

5.0 SUMMARY

In this unit, the sources of water, principles of safe water were discussed. The unit discussed the sources of water pollution, water purification and treatment at home.

6.0 TUTOR/MARKED ASSESSMENT

1. Discuss any three methods of water purification at home
2. What re the principals of safe water?
3. What are the objectives of water purification?

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UNIT 3 NOISE POLLUTION

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Definition of Noise Pollution
 - 3.2 Factors that Influence Individual's Reaction to Noise
 - 3.3 Measurement and Sources of Noise
 - 3.4 Sources of Noise
 - 3.5 Health Effects of Noise
 - 3.6 Benefits and Control of Noise
 - 3.7 Control of Noise
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor/Marked Assessment
- 7.0 References/Further Reading

1.0 INTRODUCTION

The preceding units have discussed air, and water pollution as deleterious to health of man and other inhabitants of the environment. This unit will further discuss another important aspect of environmental pollution which is noise pollution.

2.0 OBJECTIVES

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

- Define noise pollution and state the factors that influence individual's reaction to noise.
- Describe the measurement of noise.
- State the sources of noise.
- Identify the health effects of noise.
- List the benefits of noise.
- Discuss the measures for controlling noise pollution.

3.0 MAIN CONTENT

3.1 Definition of Noise Pollution

Noise is defined as an extraneous level of sound. Noise pollution is an unwanted or extraneous sound made by such products of civilization as trucks, air-planes, industrial machinery and so on. Sound which is acceptable to an individual may not be acceptable to another and sound

which is acceptable in the morning may not be acceptable in the evening. Noise is being measured in decibels. It may adversely affect human being physiologically and psychologically and because it is an insidious pollutant, damage is usually long range and permanent.



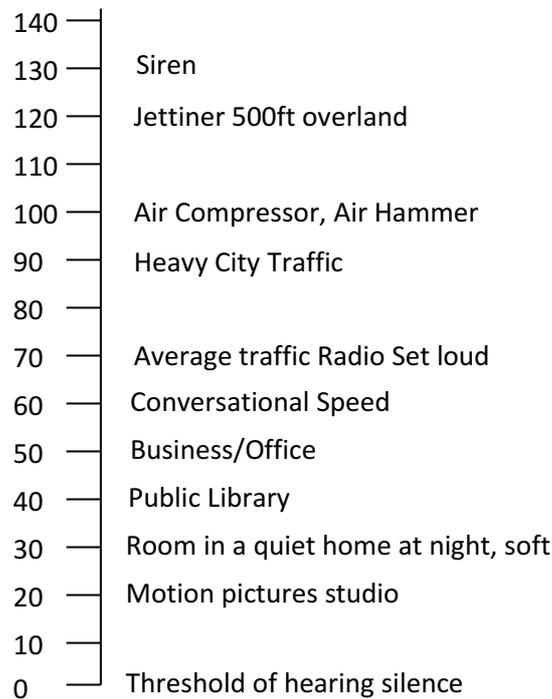
Fig 12: Automobile Generated Noise Pollution

3.2 Factors that Influence Individual's Reactions to Noise

1. **Frequency** - The higher the frequency the greater the annoyance.
2. **Loudness** - The louder the noise, the greater the nuisance. It has been found that there is a general dislike to noise related to loudness than any other factor.
3. **Unexpectedness** - Noise which is not expected is annoying.
4. **Uncertainty of direction and Unfamiliarity** - It is always normal and natural to experience a sense of unrest until the direction and source of noise is established.
5. **Irregularity and Duration** - Noise which is not regular and smooth is annoying.
6. **Necessity** - if the noise is thought to be unnecessary, it is annoying.
7. **General State of Health** - Poor health or emotional instability lowers the tolerance level of acceptability.
8. **Level of background Noise** - The difference between a noise and the background noise is very important. The greater the difference the greater is the annoyance likely to be.

3.3 Measurement of Noise

Noise is measured in decibel (DB)



3.4 Sources of Noise

1. Construction Noise - All the activities that involve the sitting and use of temporary static equipment and of mobile plant.
2. Road Traffic Noise
3. Air Craft Noise
4. Train Noise
5. Occupational Noise

3.5 Health Effects of Noise

The human ear is made in such a way that sound pressure waves caused by vibrations set the eardrum (tympanic membrane) in motion. There is three bones in the middle ear; the hammer, anvil, and stirrup. These three bones, physically amplifies the motion received from the eardrum and transmit it to the inner ear. Prolonged exposure to noise of a certain frequency pattern may cause: Temporary hearing loss or permanent loss e.g. People who worked in noisy environments commonly find that at the end of the day, they hear worse.

- 1) Repeated noise over a long period of time results to permanent threshold shift. This happens most in

industrial environment where people are subjected to noise of a certain frequency.

- 2) Noise also affects the functioning of the cardiovascular system.
- 3) It alters the rhythm of the heartbeat
- 4) It makes the blood to thicken and it dilates blood vessels.
- 5) It affects the focusing of the eyes
- 6) Excessive noise also causes headache and irritability.
- 7) It delays recovery from illness
- 8) It interferes with concentration making the individual unable to achieve his or her goal.
- 9) It can arouse fear or insecurity.

3.6 Benefits of Noise

1. It can help in stimulating someone who is drowsy
2. It can be used to attract attention
3. It can serve as an indicator that something is going to happen

3.7 Control of Noise

- i. A code of practice has to be issued for the guidance of industries and authority. It has to be enforced by the government on operation and construction site for industries.
- ii. Health educating the masses on the effects of noise.
- iii. Motivating community actions against noise related problems.
- iv. To mount programme, campaign and conduct researches on noise related issues.
- v. Removal of noise source from areas where people live to a lonely zone.
- vi. The Environmental Health Department should co-operate with the Town Planning in the control of development to avoid noise pollution in the environment.

SELF-ASSESSMENT EXERCISE

1. Define noise pollution
2. List and describe any four factors that can influence individual's reaction to noise
3. Describe the measurement of noise in decibel (DB)

4.0 CONCLUSION

This unit has described noise as an extraneous level of sound. It highlighted that individual could be adversely affected when exposed to noise and the damage could be long range or permanent. The knowledge you have gained in this unit will help you to understand the fact that

exposure to noise could be very dangerous to your health. It therefore becomes necessary that you avoid exposure to noisy environment. The knowledge will also help you in motivating community actions against noise related practices.

5.0 SUMMARY

The focus of this unit was on noise pollution, the definition and factors that influence peoples' reaction to noise. The unit looked also at the measurement and sources of noise as well as the effects, benefits and measures for controlling noise.

6.0 TUTOR/MARKED ASSESSMENT

- 1) Identify the sources of noise
- 2) What are the health effects of noise?
- 3) What measures could be adopted to control noise?

7.0 REFERENCES/FURTHER READING

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UNIT 4 SOIL POLLUTION

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Contents
 - 3.1 Definition of Soil Pollution
 - 3.2 Causes of Soil Pollution
 - 3.3 Effects of Soil Pollution
 - 3.4 Control Measures for Soil Pollution
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor/Marked Assessment
- 7.0 References/Further Reading

1.0 INTRODUCTION

Soil is another aspect of the environment that suffers from pollution. For instance, the domestic and industrial waste products that are being generated by man are full of chemical substances that are harmful to the soil and could damage the soil composition. Soil also gets contaminated from wastes generated from natural sources such as dead plants and rotten animals. This unit will throw light on soil pollution with emphasis on the sources, effects and control.

2.0 OBJECTIVES

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

- Define soil pollution and state the causes of soil pollution
- Discuss the effects of soil pollution
- Discuss the measures for controlling soil pollution

3.0 MAIN CONTENT

3.1 Definition

Soil pollution is also called land pollution. Soil is part of the environment that is essential to man. It is on the soil that plants grow what man eats and that is where we live and conduct all our activities. Aesthetic lack of the soil also enhances the beauty of nature. Soil suffers pollution due to the activities of man and that of nature. For instance, agricultural and industrial activities are producing toxic chemicals that contaminate the soil. Also nature produces waste materials such as dead

plants and carcasses of animals. These can fertilize and enrich the soil but can as well produce toxins that pollute the soil.



Fig 13: Polluted Soil

3.2 Causes of Soil pollutions

- a) **Waste disposal:** waste could be very dangerous to the soil waste originates from two sources: man-made waste and natural waste. Waste arising from man's activities includes domestic wastes and industrial wastes. Human urine and faeces are also dangerous to the soil because sometimes they are dumped directly into landfills and not channelled properly into the central sewage treatment centre. The urine and faeces contain toxic and chemicals which when in contact with the soil cause soil pollution.
- b) **Industrial activities:** This is the most dangerous of all the soil pollutants. It has caused great problems to the soil in the present decade following from the proliferation of manufacturing industries in the environment. The extraction industries such as coal mining and iron mining industries, extract minerals from the soil and the by-products are dangerous to the soil. These by-products are not properly disposed. They are dumped into the landfill and sometimes on the soil surface causing soil pollution.
- c) **Agricultural activities:** the improvement in technology has been a major problem to the soil as it has resulted to the production of varieties of pesticides and fertilizers. These are made with chemicals that are hostile to the soil since the soil cannot break them down and cannot absorb them. They mix with

rain water and seep into the soil and gradually destroy the fertility of the soil.

- d) **Acid rain:** When pollutants present in the atmosphere mix up with rain and fall on the ground again, it results to acid rain. This polluted rain water has the potential for dissolving soil nutrients and can change the soil structure.
- e) **Oils spills:** Oil spills affect soil around areas located near oil industries. It can also happen within fuel stations. Oil is laden with chemicals and the chemicals contaminate the quality of soil, destroying the chemistry of the soil.

3.3 Effects of Soil Pollution

Almost all aspects of our daily lives are dependent on the soil and when the soil is polluted, man bears the greatest brunt:

1. Polluted soil affects the plants that supply man food, the ability of plants to produce seeds, leading to hunger and famines
2. Crops and plants that are grown on polluted soil absorb the pollution from the soil and pass it to man, resulting to acute and chronic illnesses.
3. Man's exposure to a polluted soil for a long period of time can cause change in his genetic make-up.
4. Polluted soil emits some poisonous substances into the air which causes serious health problems to man when inhaled
5. Polluted soil can affect livestock, if exposed for a long time and it can lead to food poisoning.
6. Polluted soil affect the fungi and bacteria that line in the soil and bind the soil together. This is because the pollutant changes the chemistry of the soil which affects the organisms. This also affects the fertility of the soil, giving rise to unfavourable conditions for plants and vegetables to grow.
7. Because of the presence of toxic chemicals in the soil that pollutes the soil, soil fertility will be affected. The fruits and vegetables that are produced in such soil become hazardous because it will lack required nutrients and it may absorb some chemical substances that cause illnesses to the consumers.
8. Many soil organisms die as a result of toxic chemicals in the soil. This can result to change in the soil structure.
9. The toxins in polluted soil can percolate gradually and continuously into the water table. It can poison the underground water. When this type of water is consumed or used for a long time it causes diseases such as food poisoning and other intestinal problems.

3.4 Control Measures for Soil Pollution

- a) **Reduced use of chemical fertilizers.** While fertilizer seems to be doing well to the soil, the effects outweigh the benefits. Excess use of fertilizer pollutes the soil and destroys the Ph level of the soil and the needed microorganisms in the soil. It is therefore necessary that the soil be nurtured naturally to improve its fertility and quality.
- b) **Use of natural manure:** Natural manure should be advocated for in place of fertilizer. Natural manure provides the soil with the required nutrients and does not produce any harmful substances that affect the soil.
- c) **Proper waste management:** waste products from homes and industries should be properly managed. Some obnoxious methods such as burning of refuse, and open dumping should be discouraged
- d) **Involve community members in controlling soil pollution:** Every member of the community should be involved. When they get involved, they help proffer solutions and also adopt available solutions meant for controlling the soil from pollution. Their involvement will also help them in participating in any awareness programme that may be designed for their understanding of the concept of soil pollution and the need to protect the soil from being polluted.
- e) **Avoid deforestation:** There is need for the environment to go green. Deforestation leads to soil erosion and wasting away of soil nutrients. There is need for reforestation of deforested land and aforestation for barren land.

SELF- ASSESSMENT EXERCISE(S)

1. What is soil pollution?
2. Discuss the causes of soil pollution.

4.0 CONCLUSION

This unit has provided you with the knowledge of the activities that pollute the soil and subjects it to easier erosion by water and air. You have also learnt the necessary measures to be adopted in order to avoid soil pollution. You are therefore expected to create awareness and avoid such practices that could lead to the pollution of soil.

5.0 SUMMARY

In this unit soil pollution was discussed. The unit looked at the causes, effects and control of soil pollution. The study revealed that manure

should be preferred to chemical fertilizers and that members of the community should be involved in the management of waste in order to effectively control soil pollution.

6.0 TUTOR/MARKED ASSESSMENT

1. Identify any 3 measures for controlling soil pollution.
2. Discuss the effects of soil pollution.

7.0 REFERENCES/FURTHER READING

Link to:

<https://www.conserve-energy-future.com/about>

<https://www.conserve-energy-future.com/advertise>

<https://www.conserve-energy-future.com/category/energy-articles>

<https://www.conserve-energy-future.com/category/gardening>

<https://www.conserve-energy-future.com/global-warming>

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UNIT 5 FOOD HYGIENE AND POLLUTION

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- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Contents
 - 3.1 Food Hygiene
 - 3.1.1 Aims of Food Hygiene
 - 3.1.2 Principles of Food Hygiene
 - 3.2 Food Pollution
 - 3.2.1 Causes of Food Hygiene
 - 3.2.2 Effects of Food Pollution
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor/Marked Assessment
- 7.0 References/Further Reading

1.0 INTRODUCTION

Food is either liquid or solid substances taken into the body system to promote growth and development and to sustain life. Food is polluted when there is an introduction into the food toxic chemicals which are not naturally present in the food. This unit will discuss food hygiene. It will also discuss food pollution, causes of food pollution and the effects of polluted food to the body system.

2.0 OBJECTIVE

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

- Discuss the term food hygiene
- Identify the causes of food pollution
- Mention the effects of food pollution

3.0 MAIN CONTENTS

3.1 Food Hygiene

Food is any substance either in liquid or solid form which when taken into the body system, nourishes the body, promote growth and development and sustains life. Food hygiene refers to all sanitary measures, including principles and procedures adopted to ensure that food is free from agents of contamination or pollutants causing diseases or illnesses. Food hygiene practice is a sure means of protecting the food

from pollutants or infective agents in order to promote health and well-being.

3.1.1 Aim of Food Hygiene

The major aim of food hygiene is to avoid pollution of food and prevent diseases caused by polluted food. To affect this, the environmental health officers are professionally trained to carry out the duties of ensuring that food is safe for consumption. They carry out the following roles in order to achieve the aim of food hygiene (1) Enforcement of good hygiene rules and regulations. (2) Advice on the required standard to be achieved regarding the rules and regulation guiding food hygiene. (3) Carrying out health education on food hygiene to food handlers.

3.1.2 Principles of food hygiene

a) Overall personal hygiene;

- (i) Washing of hands
- (ii) Wearing protective cloth
- (iii) Covering one cuts or boils in the body
- (iii) Cutting the finger nails
- (v) Avoid sneezing or coughing over food
- (vi) Avoid touching the mouth, nose and face.

b) Growing of foods:

- Crops, fruits and vegetables should not be planted in a polluted soil or near polluted work table.
- The use of pesticides, and herbicides should be avoided.
- Polluted water should not be used for the irrigation of growing plants.
- Use of fertilizer should be discouraged.

c) Storage:

- (i) Food stores must be well ventilated.
- (ii) The temperature should be below 10°C.
- (iii) Stored items and the storing items must be checked regularly.
 - (iv) Good and quality storing system should be adopted.
- (iv) Good packaging

d) Preparation:

- (i) Wear apron and cover your hair, mouth and nose while preparing food.
- (ii) Food utensils should be properly cleaned and sterilized before use.
- (iii) Environment (kitchen) where food is being prepared should be kept clean.
- (iv) Wash your hands before cooking packing food.
- (v) Do not touch your face while you cook or package food.
- (vi) Wash your vegetables and fruits in clean running water.

e) Serving:

- (i) Wear apron and cover hair.
- (ii) Do not cough or sneeze when serving food.
- (iii) Food being served should be properly covered and served in a tray and not bare hands.
- (iv) Do not serve in absentia.
- (v) Cutleries should be wrapped with serviette and kept on the tray.

g) Eating:

- (i) Wash your hands properly before eating.
- (ii) Sit in a relaxed position to eat your meal.
- (iii) Do not talk when you are eating.
- (iv) Do not sneeze or rob your face as you eat.
- (v) Eat in a clean environment.

3.2 Food Pollution

Food pollution is the presence in food of toxic chemicals or biological contaminants which are not naturally present in the food or which are natural in the food but are above the natural background levels in the food. This implies that some food contain toxic chemical in their natural form but when it is present in the food above its normal level, it in-turn pollutes the food. Example of such food is cassava.



Fig 14: Exposed Food

3.2.1 Causes of Food pollution

A lot of factors cause food pollution any alteration in the principles of hygiene leads to food pollution.

- Growing of food (e.g. crops, fruits, vegetables) in polluted soils, solid wastes (e.g. mine tailings) or areas with polluted groundwater;
- Irrigation of grown food (e.g. vegetables, fruits, crops) with
- Growing of food (e.g. crops, fruits, vegetables) in areas with polluted air;
- Agricultural treatments with pesticides;
- Agricultural application of sewage sludge and/or polluted fertilizers (which contain ash from power plants);
- Consumption of polluted water and/or food by fish or other animals;
- Food processing, packaging, and handling;
- Propagation and concentration of pollutants through the food chain.

3.2.2 Effects of food pollution

1. It causes mild to severe food illnesses and could result to serious health problems such as hormonal and mental health problems in the body system of the consumer.
2. It can induce problem of the nervous system when the food is polluted by pesticides.
3. Consumption of highly polluted food is leads to food poisoning and death, which occurs instantly.

4. Consumption of polluted food can trigger other health-related problem in the body and this could sometime be life-treating diseases.

SELF-ASSESSMENT EXERCISES

1. List the principles of food hygiene
2. Discuss the effects of food pollution

4.0 CONCLUSION

You have learnt from this unit that food is very essential for life. Food hygiene must be maintained following some principles in order to avoid its pollution. You are then expected to apply the knowledge in the way you handle food both at the storage, serving and eating points.

5.0 SUMMARY

This unit discussed food hygiene and food pollution and causes of food pollution. The unit also highlighted the effects of food pollution.

6.0 TUTOR/MARKED ASSESSMENT

- 1) Define the following terms:
 - i) Food hygiene.
 - ii) Food pollution.
- 2) What are the aims of food hygiene?

7.0 REFERENCES/FURTHER READING

Link to:

<https://www.environmentalpollutioncenters.org/water/>Water pollution

<https://www.environmentalpollutioncenters.org/herbicides-insecticides/>Herbicides/Insecticide

<https://www.safewater.org/fact-sheets-1/2017//23/conventional-water-treatment>

<https://www.safewater.org/fact-sheets-1/2017/1/23/what-is-chlorination>
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MODULE 4 VECTOR CONTROL

MODULE INTRODUCTION

Insect vectors play significant roles in the transmission of diseases in the environment. Their presence in the environment has been a great source of danger to the ecosystem. This module will be looking at the common insect vectors that transmit diseases in the environment. Their control measures will also be discussed.

Unit 1 Arthropods and Zoonosis

Unit 2 Vector control

UNIT 1 ARTHROPODS AND ZOONOSIS

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Vectors
 - 3.2 Arthropods
 - 3.3 Zoonosis
 - 3.3.1 Classification of Zoonosis
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor/Marked Assessment
- 7.0 References/further reading

1.0 INTRODUCTION

Arthropods are invertebrate insects that transmit diseases. The transmission is biological because the life cycle of the parasite it transmits is being completed in the body of the arthropod. This unit will describe the arthropods and the various forms of arthropods. It will also classify zoonosis which is the means by which infection is being transmitted.

2.0 OBJECTIVES

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

- Give the meaning of arthropods
- Classify zoonosis

3.0 MAIN CONTENT

3.1 Vector

Vector is an insect or any animal such as rat and mosquito that carries a particular disease from one living thing to another. The vector may acquire the infection from an infected host e.g., mosquito or it may acquire the infection congenitally by trans-ovarian passage e.g., mites in scrub typhus. The vector may transmit the disease mechanically as in case of housefly resulting to shigellosis in gastro-intestinal infections. The contraction of vector-borne viruses is known as "arboviruses, these causes a variety of clinical syndromes such as Fever, Aseptic meningitis, Encephalitis and Hemorrhagic fever.

3.2 Arthropods

They play an important role in the transmission of diseases, sometimes a determinant role. It is an invertebrate animal such as an insect, spider, or crab, which has its skeleton on the outside of its body and has joints on its legs. From the above definition, it can be deduced that: Arthropods is an invertebrate animal. Some live in water while some on land. They have jointed pairs of legs. They have outside skeletons. The transmission of arthropod-borne diseases is biological because the essential part of the life cycle of the parasite takes place within the body of the arthropod. Some examples of Arthropod-borne diseases include:

- a) **Viruses** - causing fever, Aseptic Meningitis, Encephalitis Haemorrhagic fever etc.
- b) **Rickettsia** - causing house-borne typhus, marine typhus, scrub typhus, tick-borne typhus etc.
- c) **Bacteria** - causing Bubonic plague, bacilliform etc.
- d) **Helmets** - causing Wuchereria bancrofti, Onchoceerca volvulus, etc,
- e) **Protozoa** - causing Malaria, Trypanosome gambienze, etc

3.3 Zoonosis

Zoonosis means a disease or infection transmitted.

3.2.1 Classification of Zoonosis

- a) **Direct Zoonosis** - in this case, the disease is being transmitted from a vertebrate host to a susceptible host without the causative agent undergoing

changes or any essential developmental changes in the cause of transmission

process. The transmission is by direct contact with the mechanical vector

e.g., brucellosis that is transmitted from goat, sheep.

- b) **Cyclo-Zoonosis** - More than one vertebrate host is involved so that the developmental cycle of the causative agent is complete e.g., tape worm or teaniasis
- c) **Meta Zoonosis**- In this case, invertebrates transmit the disease biologically to the vertebrates and the vertebrates will then transmit it to one another e.g., Schistosomiasis (Bilharzias).
- a) **Saprezoosis**- This requires both vertebrate and inanimate hosts or non animal or reservoir for its development e.g. ring worm, athlete's foot etc.

SELF- ASSESSMENT EXERCISE(S)

1. Identify five examples of arthropods, giving two examples of the diseases each could cause.
2. Give the classification of zoonosis

4.0 CONCLUSION

The unit has provided you with the knowledge of arthropods – borne diseases. It has also described the means by which diseases are transmitted in the environment. It is expected that the knowledge you have acquired from this unit will help you in maintaining personal and environmental hygiene in order to avoid transmission of arthropod-borne diseases.

5.0 SUMMARY

This unit focused on arthropods and arthropod- borne diseases. It also classified zoonosis.

6.0 TUTOR/MARKED ASSESSMENT

1. Differentiate between the terms vector and arthropods
2. Identify any five examples of diseases caused by arboviruses

7.0 REFERENCES/ FURTHER READING

Link to:

<https://www.slideshare.net/mastz04/chapter5a>

[https://www.wise-geek.com/what-is vector.control.htm](https://www.wise-geek.com/what-is-vector-control.htm)

<https://journals.plos.org/plosntds/article?d=10.1371/journal.pntd.0007831>

[https://www.ivcc.com/vector-control.](https://www.ivcc.com/vector-control)

UNIT 2 VECTOR CONTROL

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main content
 - 3.1 Infective agents, their habitats and diseases they cause
 - 3.2 Mode of transmission of vector-borne infections
 - 3.3 Vector control measures
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor/Marked Assessment
- 7.0 References/ Further Readings

1.0 INTRODUCTION

The unit preceding this unit discussed vector, arthropods borne diseases and classified zoonosis. This unit will be interested in identifying infective agents, their habitats and the diseases they cause. In this unit also, the control measures for vector infestation and vector-borne diseases will be x-rayed.

2.0 OBJECTIVES

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

- Describe infective agents, their habitats and the diseases they cause
- Discuss the mode of transmission of vector-borne diseases
- Discuss the measures for vector control

3.0 MAIN CONTENT

3.1 Infective Agents, their Habitats and the Diseases they Cause

Table 3: Infective Agents, their Habitats and Diseases they Cause

S/N	AGENT	HABITAT	DISEASES
1.	Mosquitoes	Houses, bushes, stagnant water, ponds, blocked drains, empty cans, leaf branches.	Yellow fever, dengue fever, malaria fever.
2.	Cockroach	Dark humid places like	Food poison,

		cupboards, toilets, drawers, wardrobes etc.	gastro intestinal diseases.
3.	Housefly	Toilets, dumping sites, in sanitary environments.	Dysentery, typhoid fever, diarrhea, cholera etc.
4.	Lice	Hostels, prisons, camps and houses.	Typhus and relapsing fever.
5.	Tsetse fly	Bush, river banks and dark houses.	Sleeping sickness (Trypanosomiasis)
6.	Simulium	Bush and river banks	River blindness (Onchocerciasis)
7.	Dogs, cats, rats	Domestic animals bush houses, ships, etc.	Rabies, plague.

3.2 Mode of Transmission of Vector-borne Infections

Through **mechanical transfer** of infection in which case the vector may carry the infective agent on its body, or the infective agent may be ingested by the vector and the vector passes it through its excreta unmodified. Through **biological transmission** - in this case, vector bites a host and acquires the infective agent from the blood or skin tissue of the infested host. The infected vector may inoculate infective agent from its salivary secretion into a new host e.g., malaria.

Contamination of mucous membranes or skin: This is by the faeces of the vector or the host being infected by the tissue fluid of the infective agent if crushed, e.g., electric ant.

Through ingestion of vector or infective agent e.g., Tape worm, guinea worm, when their infected Cyclops is ingested by man.

3.3 Vector Control Measures

Three measures are necessary for the control of vector namely:

1. Controlling the Infective agent
 - 1.3 Controlling the Route of Transmission
2. Controlling the Host

Infective Agents - The infective agents can be controlled by

- (a) Destruction of animal reservoir e.g., de-rating, debating processes,
- (b) Isolation and treatment of infected persons keeping the infected person away from the uninfected persons.

Route of Transmission - In this case, you can affect adequate control by.

- (a) **Controlling the Vectors** - By preventing the vector from coming into contact with the human host - This you can achieve by creating,
 - (i) Biological barriers such as blocking their ways of entry, removing all resting and breeding places from the vectors, avoiding dump places for house sitting to prevent mosquitoes breeding.
 - (ii) Mechanical barriers such as the use of mosquitoes net, covering your skin, use of repellents and so on.
- (b) **Destruction of the Vectors which include:**
 - (i) Trapping, collection and destruction of the vectors e.g., rat traps, sticky strips for flies etc. (ii) Chemical insecticides - some are directed against the adult vectors while some against its larval, (iii) Biological methods such as alteration of the physical environment like drainage constructions, drying of lakes etc.

Host - The host can be protected through

- (a) Immunization with dead or attenuated virus e.g. oral polio vaccine.
- (b) Use of chemoprophylaxis e.g., Sunday - Sunday medicine for malaria.

SELF-ASSESSMENT EXERCISE(S)

Describe the three measures necessary for vector control

1. In a tabula form, describe any six infective agents, indicating their habitants and the diseases they could cause.

4.0 CONCLUSION

You have learnt from this unit that some of the infective agents live with man and are also found in our other environments. They could cause diseases by way of ingestion, biting or personal contact with the infective agent. The knowledge gained from this unit is very crucial in addressing the issue of environmental sanitation and cleanliness.

5.0 SUMMARY

In this unit, some of the infective agents, their habitats and the diseases they could cause were highlighted. The mode of transmission and control measures were also discussed. It was indicated in the unit that when the infective agents, route of transmission and host are put in check, vectors would be controlled.

6.0 TUTOR/MARKED ASSESSMENT

- 1) Discuss the following means of controlling vectors:
 - i) Route of transmission and
 - ii) Destruction of vectors.
- 2) Identify and discuss the various modes of transmission of vector-borne infections.

7.0 REFERENCES/ FURTHER READING

Link to:

<https://doi.org/10/1371/journal.pntd.0007831>

<https://www.ivcc.com/vector-control>

<https://www.slideshare.net/masz04/chapter5a>

<https://sciencedirect.com/topics/medicine-and-dentistry/vector-control>

MODULE 5 HOUSING AND SCHOOL SANITATIONS

MODULE INTRODUCTION

In this module, housing and school sanitation will be discussed. Housing is an important aspect of environmental health because that is where people live and carry out most of their lives activities. Houses should therefore be satisfactorily built with approved standards and regulations in order to protect the occupants from contacting infectious diseases and experiencing other household hazards. School in other hand, is an environment where learners spend most of their time and it is an environment for learning. It should be made disease free and conducive for learning to take place. Discussion on school sanitation is important because when a child contacts disease from school, the child has the propensity for transmitting the disease to the family and from the family it could affect the entire members of the community.

- Unit 1 Housing and environment
- Unit 2 School sanitation

UNIT 1 HOUSING AND ENVIRONMENT

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main content
 - 3.1 Housing and environment
 - 3.2 Housing and Community Development
 - 3.3 Requirements for a Satisfactory House
 - 3.4 Types of Building and their environmental Health Implications.
 - 3.4.1 Type A Building
 - 3.4.2 Type B Building
 - 3.4.3 Type C Building
 - 3.4.4 Type D Building
 - 3.5 Effects of Poor Housing on Man
 - 3.5.1 Biological Effect
 - 3.5.2 Social Effect
 - 3.5.3 Physical Effect
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor/Marked Assessment
- 7.0 References/ further reading

1.0 INTRODUCTION

Well constructed and clean house promote physical, emotional social and mental health. On the other hand, poor housing creates health problems such as communicable diseases, chronic diseases, injuries, and psycho-social problems. This unit will discuss the relationship between housing and environment. It will also highlight the relationship between housing and community development and the requirements for a satisfactory House. The unit will equally identify types of building, the factors that constitute poor housing and the effects of poor housing on health.

2.0 OBJECTIVES

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

- Discuss the link between Housing and environment
- Discuss housing and the community development
- Discuss the meaning of Housing
- State the requirements for a satisfactory house.
- Discuss types of building and their implications to the environment.
- Discuss the effects of poor housing

3.0 MAIN CONTENT

3.1 Housing and Environment

A house can be defined as a building or premises constructed within the laid down building regulations to occupy person or persons and their personal effects, possessing all the necessary sanitary conveniences, providing comfort shelter, privacy, protecting and elongating life and preventing diseases associated with housing. There are different types of housing which should be provided within the limits of capital available which still provide conditions of comfort, health and enjoyment required for the making of a home and for enjoyment of a family. The provision of good housing is an important aspect of environmental health because it represents the following:

- a) A major part of man's environment
- b) Provides shelter from the elements
- c) Provides kitchen for the house wife, the playroom for the children and tool shed for adult males.
- d) Provides residence for the family (Home) where social institution carries

out some of its major functions.

- e) It equally minimizes physical, biological and social hazards.
- **Physical** - A house that is well designed with all the requirements for a quality building put in place will control injury coming from hazards such as burn, electric shock, fall, cold, or excessive temperature etc.
 - **Biological** - A well-constructed house that is spacious and not overcrowded will protect the inmates from contracting communicable diseases.
 - **Social** - This refers to culture and privacy.

3.2 Housing and Community Development

Housing is very much related to community development since one cannot talk about community development without making reference to healthy residential environment, facilities, services and environmental conditions which are essential for health promotion and optimal health. Community development refers to the plan of environmental structure and infrastructure and the position of basic amenities to modernize the community and promote physical, mental, emotion and social well-being. The above definition suggests the need for the Environmental Health workers to liaise with Community Development workers in planning and designing the community environment in such a way that will enhance the achievement of health promotion among the populace. The World Health Organization has given some detailed requirements of a healthy residential environment for community development.

1. Proper siting and construction of a residence to provide fundamental, Psychological and sanitary requirements.
2. Type of houses to build should depend on the different climate of the environment. For instance, housing in the tropic differs from the housing in the arid zones.
3. There should be standards for building housing for industries, plantation, running and so on. These standards should be in terms of size, floor, and air space, ventilation, cooking structure, sanitary facilities, storage and water supplies.
4. In order to address the issue of urbanization and rapid population in the cities, there is need for the provision of adequate low-cost housing. This should be a primary responsibility of the government and municipal authorities.

3.3 Requirements for a Satisfactory House

1. It should be well sited and made permanent on a good soil -
 - a) Clay soil hold water, sandy soil doesn't absorb water and it is prone to erosion.
 - b) Hill side is better site for buildings than valley
 - c) There is need for space surrounding the building which will be used for other purposes like recreation and gardening.
 - d) damp proof course and a smooth floor,
 - e) A strong walls and waterproof roof,
 - f) A safe, portable and conventional water supply,
 - g) A Proper drainage system,
 - h) Sanitary convenient water supply,
 - i) Good natural and artificial lightening,
 - j) Satisfactory provision for storing and food,
 - k) Adequate places for bathing and washing clothes,
 - l) Good ventilation system,
 - m) Roper means of heating (where necessary),
 - n) Enough space for the number of people in the family to be able to sleep without being close to each other.

3.4 Types of Building and their Environmental Health Implications

Basically, there are four types of building being used in our environment namely

- 1) Type A building.
- (2) Type B building.
- (3) Type C building.
- (4) Type D building

3.4.1 Type A Building



I

These are constructed mainly by government and very few rich individuals or highly placed officials of the government. The requirements include:

- a) It is sited on a good soil less from pollution and away from highway.
- b) It is constructed with strong or impervious materials.
- c) It is well concreted and plastered.
- d) The walls are strong and the floor supported with proof course.
- e) It has adequate rooms with standard size measurements.
- f) It has a properly constructed borehole water supply.
- g) It has a well-constructed drainage system to lead away waste water and run-off water.
- h) Adequate facilities are provided for the sanitary disposal of waste and refuse.
- i) There is an adequate ventilation system (natural, artificial)
- j) It has a properly fitted roof made of water proof material.
- k) The premises are properly fancied and the surroundings well concreted.
- l) Mosquitoes' gauze is provided in the entire jamb opening.

Specifically, Type A Building is comprised of all the laid down existing building specifications.

3.4.2 Type B Building

These are buildings constructed mainly by individuals who enjoy comfortable economy and could conveniently afford the maintenance. The requirements for the type B Building is (75%) seventy five percent of the Type A Building. This means that the Type B Building is lacking in some of the requirements and provisions to make them meet with the standard of Type A as laid down in the existing building specifications.

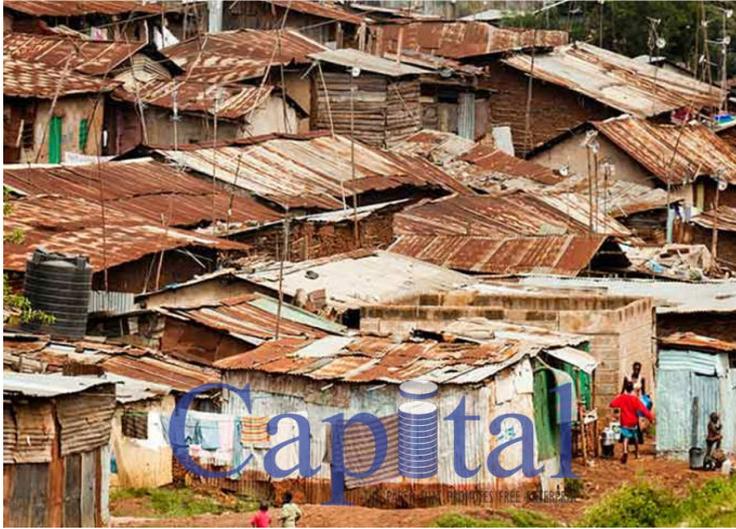
3.4.3 Type C Building

Type C buildings are the most common form of premises in the African settlements. It is owned and occupied by average citizens such as civil servants, artisans or farmers. It is very common in sub-urban settlements and many urban towns.

1. They are constructed with mild materials such as mud blocks, slightly strong brick material.
2. Site selection is not necessarily taken into consideration.
3. Sanitary requirements are almost absent or partially provided

4. There may be presence of dilapidated wall.

3.4.4 Type D Buildings



Type D buildings are very common in the riverine areas, religious camps, refugee camps and farm settlements. They are constructed with little or no regard to the existing building and health regulations. They are regarded as temporal buildings as the materials used for the construction can not last long.

- a) They are constructed with wood, bamboo, raffia or corrugated iron sheets.
- b) It requires no structural or dimensional planning.
- c) It is deprived of all forms of sanitary conveniences.
- d) It is sited in sanitary environment liable to cause an epidemic.
- e) It does not provide enough space and usually with poor ventilation and lighting.
- f) It poses danger of rats, infestation, mosquitoes breeding and the likes.
- g) It is easy to destroy by fire and dangerous to live during the rainy season.

3.5 Effects of Poor Housing on Health

Poor housing has biological, social and physical effects on health.

3.5.1 Biological Effects

There is high risk of transmission of communicable disease. For instance, inadequate ventilation and lighting predispose the inmates to the spread of respiratory tract infections; poor spacing and overcrowding can equally predispose them to other types of infectious disease. Lack of

adequate supply of pure water will result to skin disease, and lack of sanitary conveniences will lead to other faecal-oral disease, gastrointestinal diseases and health problems.

3.5.2 Social Effects

The house should be built bearing in mind the suitable setting for bringing up children. In case where there is poor spacing and inadequate rooms, there will be lack of privacy for the adults. Factor emanates when the worker cannot operate the machine or when the worker cannot apply the available protective devices. On the other hand, when the machine refuses to operate the way it should operate.

3.5.3 Physical Effects

In a situation where the site is not considered, the building may develop some cracks and can even fall damaging life and properties. A house built within inferior materials can equally collapse or be subjected to fire outbreak. There are also hazards associated with houses without adequate kitchen accommodation. It leads to pollution of the air since the cooking is done within the living room and can easily give rise within the living room and can easily give rise to fire outbreak, burn and other physical related problems.

SELF-ASSESSMENT EXERCISE (S)

1. Discuss the requirements of a healthy residential environment for community development.
2. Identify any 10 requirements of a satisfactory house.
3. Describe the following types of building and indicate their environmental health implications:
 - i. Type B building
 - ii) Type D building.

4.0 CONCLUSION

You have been exposed to the knowledge of housing in this unit. The unit revealed that housing is major aspect of man's environment and that community development cannot be effective without making reference to satisfactory housing. The lesson you have learnt here will direct your attention to the standard of housing in your community and in your surrounding environment.

5.0 SUMMARY

This unit provided information on the relationships that exist between housing and the environment and between housing and community

development. In the unit, the requirements for statutory housing were discussed. This unit focused also on the types of building and their environmental health implications. It also detailed factors that constitute poor housing and the effects of poor housing.

6.0 TUTOR/MARKED ASSESSMENT

1. Discuss the following:
 - i. Housing and environment.
 - ii. Housing and community development.
2. Mention any ten factors that constitute poor housing.
3. Discuss the physical and biological effects of poor housing on health.

7.0 REFERENCES/FURTHER READING

Link to

- <https://www.acf.hhs.gov/ocs/programs/liheap>
- <https://www.justice.gov/crt/fair-housing-act-1>
- <https://www.ncbi.nlm.nih.gov/pubmed/11477521>
- <https://www.ncbi.nlm.nih.gov/pubmed/15015927>
- <https://www.ncbi.nlm.nih.gov/pubmed/16318602>
- <https://www.tandfonline.com/doi/abs/10.1080/10511482.2005.9521542>
- <https://www.habitat.org>
- https://www.hud.gov/progam_offices/healthy_homes/hhi
- https://www.rwjf.org/content/dam/fam/reportsissue_briefs/2011/rwjf70451
- <https://www.rwjf.org/en/search-results.htm/?at=pollacktc>
- <https://www.ncbi.nlm.nih.gov/pubmed/15015927>
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UNIT 2 SCHOOL SANITATION

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main content
 - 3.1 Concept and objectives school sanitation
 - 3.2 Objectives of School Sanitation
 - 3.3 Essential Characteristics of hygienic school
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor/Marked Assessment
- 7.0 References/ Further Reading

1.0 INTRODUCTION

School sanitation is important for overall health and well-being of the students, staff members, family member and even the entire members of the community. This is because infectious diseases got from school could spread to the family and can affect the entire members of the community. In addition, clean and aesthetic environment have the propensities for motivating students to learn and drawing the interest of parents and other members of the community to the school. This unit will focus on the concept and objectives of school sanitation, and the essential characteristics of hygienic school.

2.0 OBJECTIVES

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

- Give the concept and the objectives of school sanitation
- Discuss the essential characteristics of hygienic school

3.0 MAIN CONTENT

3.1 Concept of School Sanitation

School sanitation is an aspect of environment, sanitation that has to do with the creation and maintenance of hygienic and aesthetic environment in schools in order to promote health and prevent diseases among students and staff. For a school to be successful there must be provisions for clean and safe environment. When the school environment is not hygienic, it can affect students and staff biologically, physically, and mentally and so on. School sanitation involves a number of factors such as proper sitting of the school buildings or structures

waste disposals, and provision of sanitary conveniences. School sanitation helps in checking illnesses and absenteeism among students and staff. It also fosters motivation for teaching and learning and improves interest of parents and other community members for a given hygienic school.

3.2 Objectives of School Sanitation

1. To bring about positive attitude, behaviour and practice of hygiene in schools
2. To protect students and staff from adverse effect of insanitary environment
3. To foster the provision of required sanitary facilities in schools.
4. To encourage compliance with the rules and regulations guiding sanitary practices in schools
5. To inculcate in the students, the virtue of hygiene practices.
6. To improve community health since the combination of adequate facilities, correct practices and knowledge is meant to have a positive impact on the health and hygiene conditions of the community.
7. To create aesthetic and ambient environment that promotes teaching and learning
8. To absorb and popularize new ideas and concepts of sanitation in the school which spills to the community.

3.3 Essential Characteristics of School Sanitation

The essential characteristics of school sanitation include:

- (1) Sitting
- (2) Building structure
- (3) Classroom sanitation
- (4) Waste management
- (5) Drinking water
- (6) Sanitary conveniences
- (7) First aid box
- (8) Playground
- (9) Canteens
- (10) Professional cleaning services

- (1) **Sitting:** The site must not be swampy or damp area to avoid biological hazards. It should be sited on a loamy soil. The school must not be sited on a reclaimed land because it could collapse if the reclaimed land had not lasted the required number of years (5-10 years). The school should not be sited near nosing

environment such as market and sawmills and should also not be sited near a major road.

- (2) **Building structure:** The structure of the school buildings must be made to meet standards- the walls of the buildings should be well plastered and the classroom floor must be made with rough concrete or rough tiles to avoid slipping floor that could lead to fall- There should be cross ventilation in all the rooms of the buildings. There must be enough spaces in between buildings to allow in fresh air and natural light into the rooms. A strong and well constructed roof is required and all the materials that should be used for the building must be of good standard and durable to avoid sudden collapse
- (3) **Classroom sanitation:** The classroom appears to be one of the most important areas in the school because that is where the students spend most of their time and communal life is very common in the classroom. The classroom should have clean and smooth but not slippery floors. The seats should be suitable for the level of the students. The classroom should be adequately illuminated with proper light and should be well ventilated and spacious for easy movement.
- (4) **Waste management:** School generates huge amount of waste and the wastes should be properly managed. All the offices and classrooms including all the strategic places in the school should have tight fitted waste bins. These will serve as the generation points for waste management. A standard central waste disposal facility should be provided. This could be preferably, incinerator in case where incinerator is available because incinerator is the best in dealing with combustible wastes and school wastes are usually combustible wastes.
- (5) **Drinking water:** The source of drinking water is crucial for the health and well-being of students and staff. It is necessary that the school have a good source of drinking water such as tap water and borehole, which should be made readily available at all times. The tap water should be located in different sides of the school compound since it is serving a large number of students and staff.
- (6) **Sanitary conveniences:** Latrine accommodation should be made available for the conveniences of students and staff and for safe and proper excreta disposal. The most preferable is ventilated improved pit latrine (U.I.P). The V.I.P latrine should have multi-compartment to serve the number of staff and students. Students should have their own compartment while the staff should have theirs. The latrine should be kept clean on daily bases and should be located a bit far, from the classrooms and offices.
- (7) **First aid services:** First aid services should be made available and the centre located in a strategic place in the school. The

centre should be well equipped with materials and drugs. The school should have a medical staff that should be in charge of the first aid treatment services. The staff could be a nurse or trained health professional, whose role is to administer first aid treatment to an injured student or staff and to refer cases where it has goes out of hand.

- (8) **Playground:** A spacious playground that is free from hazardous materials should be provided. It should be kept clean to ward off rodents and venoms. There should be no pot holes in the playground to allow free physical exercise required for physical fitness of the students.
- (9) **Canteens and school meals:** School sanitation cannot be properly achieved without reference to canteens and school meals. It is advisable to have canteens provided under the egis of the school administration. This will help in checking the type of food that is being provided and the cleanliness of the food workers. Good school meals containing balanced diet should be provided for the student's caterers and food vendors must not be sick or suffering from any infections disease or have septic sores or cut in their body. The surrounding environment of the canteen or school kitchen must not be untidy.
- (10) **Professional cleaning services:** In order to achieve success in school sanitation, there is need to employ professional cleaners in every school. They are the ones that have a greater understanding of areas that need to be cleaned and how to clean them properly. They also provide regular and frequent cleaning services. These are trained professionals that have certificates in environmental sanitation. A good example is the Titan team. In case of the areas where the services of the professional cleaners are not available, local community members could be employed. In that case, they should be taught skills involved in school sanitation for them to perform the sanitary roles adequately.

SELF- ASSESSMENT EXERCISE(S)

1. Give six objectives of school sanitation.
2. Identify the ten essential characteristics of hygienic school.

4.0 CONCLUSION

One of the objectives of school sanitation as identified in this unit is the protection of the school children from insanitary environment and hazards. The unit also identified the provision of sanitary conveniences, classroom and building spaces and waste disposal facilities, among others, as the essential characteristic of hygienic school. It is then

expected that your knowledge of school sanitation will be of immense benefit to you in identifying.

5.0 SUMMARY

This unit discussed the concept and objectives of school sanitation. It described also the essential characteristic of hygienic school and provided knowledge on the school sanitation and hygiene education. The unit revealed that among other essential characteristics of school sanitation, professional cleaning services should be provided to enhance the attainment of cleanliness in school environments.

6.0 TUTOR/MARKED ASSESSMENT

- 1) Give the concept of school sanitation.
- 2) Discuss the following characteristics of hygienic school:
 - i) Class room sanitation.
 - ii) Waste management.
 - iii) Drinking water.
 - iv) Sanitary conveniences
 - v) First aid services.

7.0 REFERENCE/ FURTHER READING

Links to:

<https://washdata.org/sites/default/fes/200-09/JMP-202-WASH-schools>

<https://titanchs.com.mm/>

<https://titanchs.com.mm/myanmar-cleaning-services>

<https://titanchs.com.mm/myanmar-commercial-cleaning-sectors>

<https://titanchs.com.mm/before-after-photos>

<https://titanchs.com.mm/blogs>

<https://titanchs.com.mm/contact-us>

<https://titanchs.com.mm/request-free-demo>

<https://titanchs.com.mm/blog/the-importance-school-hygiene-and-sanitation>

<https://titanchs.com.mm/blog/the-importance-of-school-hygiene-and-sanitation>

MODULE 6 OCCUPATIONAL HEALTH SERVICES (OHSs)

MODULE INTRODUCTION

In the preceding module, you have learnt about school sanitation as an essential aspect of environmental health. This module will educate you on yet another important dimension of environmental health that has to do with safety of workers in their work environment and workers welfare concerns. The module will discuss occupational health services, identifying the aims and objectives of occupational health services. It will also highlight the occupational health hazards, and discuss Health Insurance as an aspect of occupational health services.

Unit 1	Occupational Health Services and Occupational Health Hazards
Unit 2	Health Insurance

UNIT 1 OCCUPATIONAL HEALTH SERVICES AND OCCUPATIONAL HEALTH HAZARDS

CONTENTS

1.0	Introduction
2.0	Objectives
3.0	Main content
3.1	Occupational Health Services
3.1.1	Objectives of Occupation Health Services
3.1.2	Advantages of occupational health services
3.1.3	Factors Required for Promotion of Occupational Health
3.2	Occupational Health Hazards.
3.2.1	Factors Leading to Occupational Health Hazards
3.2.2	Control of Occupational Health Hazards
4.0	Conclusion
5.0	Summary
6.0	Tutor/Marked Assessment
7.0	References/ further reading

1.0 INTRODUCTION

This unit will expose you to the knowledge of the aims, objectives and rationales for occupational health services. The unit will equally x-ray the factors leading to occupational health hazards and the control. In this

unit also, the advantages of OHSs the factors that are required for the promotion of OHSs will be looked at.

2.0 OBJECTIVES

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

- Identify the aims, objectives and rationales for occupational health services.
- Discuss the factors that lead to occupational health hazards
- Discuss the measures for controlling occupational health hazards.
- Discuss the general advantages of OHSs.
- Identify the factors required form the promotion of OHSs.

3.0 MAIN CONTENT

3.1 Occupational Health Services.

The term occupational health refers to the health; safety and welfare of workers inter work. The effects of the working environment on the general well being of workers and the influence of the worker's state of health on their ability to perform the task before them is the major concern of occupational health as a study.

3.1.1 Objectives of Occupational Health Services

World Health Organization and International Labour Organization on at the first session of their joint committee in 1950 gave the aims of Occupational Health as follows.

1. The promotion and maintenance of the highest degree of physical, mental and social well being of workers in all occupations.
2. The prevention among workers of departure from health caused by their working conditions.
3. The protection of workers in their employment from risks resulting from factors adverse to health.
4. The planning and maintenance of workers in an occupational environment adapted to his physiological conditions.
5. The adaptation of work to man and each man to his job.
6. To carry out or promote research into the cause of occupational diseases and injury and the means of their prevention.

3.1.2 Advantages of Occupational Health

A lot of advantages have been identified in effective administration of occupational health and safety programmes both to employers, employees, Government and the society at large.

1. Enactment of laws specifying payments to workers for industrial accidents or for illness caused by the occupation.
2. It helps to preserve the rights of workers and their duties well defined.
3. It ensures suitable job placement.
4. It promotes physical and mental well being.
5. It ensures longer life.
6. It lowers personal and organizational medical costs.
7. It sustain employee earning.
8. It ensures greater job satisfaction.
9. It contributes to the prosperity of the community.
10. It decreases welfare costs and improves public relations.
11. It gives rise to low accident rate and reduces disability.
12. It enhances efficiency.
13. It leads to high productivity.
14. It increases gross national income (GNI).

3.1.3 Factors Required for the Promotion of Occupational Health

- **Workers Wellbeing:**
 - a) Provisions of balanced diet (canteens and regular meal hours and sanitary regulation for the preparation of foods in the canteen.
 - b) Adequate rest and relaxation (break periods)
 - c) Job satisfaction and motivation which involves
 - d) Prompt payment of salary/allowances
 - e) Opportunities for promotion
 - f) Prospect for advancement
 - g) Familiarity with job.
 - h) Understanding and co-operation among employer, management and employees (social relationship).
 - i) Promotion of personal hygiene.
 - j) Pre-employment and periodic medical examination.
 - k) Provision of accommodation.
 - l) Adequate training, retraining, seminars, workshops and health education.
- **Working Environment**
 - a) Satisfactory design and maintenance of machinery.
 - b) Provisions of ventilation, lighting and atmospheric purity.

- c) Provisions of safety equipment
- d) Better relationship between man and machine
- e) Provision of adequate sanitary conditions and good housekeeping.
- f) Regular inspection of working environment.

The resultant effect of the above factors if put in place and adhered to in the workplace environments are:

- i) Healthy workforce
- ii) Low workforce
- iii) Low rate of absenteeism
- iv) Safe working conditions and operations
- v) Low accident rate
- vi) Enhancement of efficiency and high productivity.

3.2 Occupational Hazards

Occupational hazards are conditions within the work, or those associated with work that has potential of causing injury and damage to a person. Hazards are pre-disposing conditions to accident or injuries. The existence of hazard may be natural or artificial depending on the interactions that exist between materials and machines, between man and machines as well as between environment and man.

3.2.1 Factors Leading to Occupational Hazards

The factors that can lead to occupational hazards are as follows:

- a) **Physical Factors-** Such as heat, falling objects, fire etc. These can lead to accident or direct injury, loss of body parts and organ or even death. Accident is defined as unplanned and unintentional occurrences that result in damage to life or properties.
- b) **Chemical Factors-** This may come inform of vapor, gases, fumes, lead, dust and mists. Coming into contact with these materials can result to poisoning.
- c) **Biological Factors-** This refers to biological agents such as fungi, bacteria, viruses, worms and parasites which workers come in contact with in the workplace. For instance, people working in the health sectors are being exposed to hazards like hepatitis B, human immune-deficiency Virus (HIV) and so on.
- d) **Mechanical Factors-** Mechanical factors include unguarded part of machines, pointed objects, unprotected electrical cable, sharp apparatus and so on. Workers can be exposed to these types of danger e.g. power-driving tools vibrating uncountable times daily could cause stiffness of the fingers, hand cramps etc.

- e) **Psychological Factor-** The agents that affect the well-being of the human inner states that relate to the psychotic and neurotic feelings fall under this factor. These include work stressors, work overload and under load, individual role in the organization, relationship at work. Work stressors can give rise to psychological behavioural, physiological and psycho-somatic tension, anxiety, depression, drug use. These conditions can degenerate to asthma, thyroid disorders, arthritis, hypertension and ulcers.
- f) **Ergonomically Poor Working Condition-** This has to do with the relationship between man and his machine and the machine and man. This factor emanates when the worker cannot operate the machine or when the worker can not apply the available protective devices. In other hand, when the machine refuse to operate the way it should operate.

3.2.2 Control of Occupational Hazard

These are the measures taken to prevent, reduce or eliminate sources of hazards in a workplace environment.

They include:

- a) **Administrative Measurement** - Under this context, the individual, private enterprise and trade unions are involved. They should enact laws, rules and regulations protecting and promoting the health and safety of workers in any organization e.g. the Factory Act of 1990, the Mineral ordinance Act of 1990.
- b) **Engineering Measures** - Health experts and engineers should team up to design and plan organizational environment. There should be acceptable standard and constructive design like Environmental monitoring, general ventilation of the work room, grading and concreting of floors, construction of drainage, lightning system etc.
- c) **Substitution Measures** - In this case, less harmful or safe devices are introduced or improvised to replace the existing harmful, dangerous, injurious or poisonous substance e.g., the use of zinc to replace lead in paint manufacturing process; provision of air condition services and artificial lighting to complement ventilation system etc.
- d) **Personal Protective Equipments (PPES) Measures** – This is very important measure in controlling occupational hazards. It serves as the immediate and the ultimate protection for

workers in all categories of processes in a workplace. It prevents accidents, burns, bruises, wounds, falls, laceration, head injury, brain damage, deafness or impaired hearing, eye damage, and death. Examples of these protective measures are hand gloves, goggles, helmet, respirators, ear protector/mumps, rubber boots, and face masks.

SELF-ASSESSMENT EXERCISES

1. Discuss the general advantages of OHSs
2. List the components of working environment of one of the factors for the promotion of OHSs
3. Define the following items
 - i. Occupational health
 - ii. Occupational health hazards

4.0 CONCLUSION

This unit defined occupational health as the health safety and welfare of workers in their work environment. The unit identified the promotion and maintenance of highest degree of health and well-being as one of the aims of occupational health services, indicating that workers spend 2/3 of their daily time in the work environment. You have therefore learnt from this unit that occupational or work environment is as important as home and school environment and as such the safety of work environment should not be toiled with.

5.0 SUMMARY

In this unit, the aims and objectives for occupational health services were identified. The factors leading to occupational health hazards and the control measures were equally highlighted. The advantages of OHSs were discussed and the unit also provided information on the factors that are required for the promotion of OHSs.

6.0 TUTOR/MARKED ASSESSMENT

1. Discuss the factors required for the prevention of occupational hazards
2. Identify the objectives of occupational health services
5. List the nine factors that lead to occupational health hazards.

7.0 REFERENCE/FURTHER READING

“<https://www.healthypeople.gov/2020/topics-objectives/occupational-safety-and-health>”

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Jain, R.K., & Rao, S.S. (2011). *Industrial safety, health and environmental management system*. Khanna Publishers: Delhi, India.

UNIT 2 HEALTH INSURANCE

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main content
 - 3.1 Concept of Health Insurance
 - 3.2 Objectives of Health insurance
 - 3.3 Types of Health Insurance
 - 3.4 Agencies that Operate Health Insurance
 - 3.5 Benefits of health insurance
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor/Marked Assessment
- 7.0 References/further reading

1.0 INTRODUCTION

Another essential aspect of occupational health services (OHSs) is the Health Insurance. Health Insurance is designed for funding health care services for workers working in various organizations. It is designed for those employed in the government sectors, those in the private sectors and those who have retired from active services. It provides medical services to workers and buffers against their unpredictable and unexpected health problems, there by promoting emotional and mental health of the workers as they perform their job. This unit will look into the concept and objectives of Health Insurance, types and agencies for operating health insurance and the benefits of health insurance.

2.0 OBJECTIVES

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

1. Give the concept and objectives of Health Insurance.
2. Discuss the types and agencies that operate Health Insurance

3.0 MAIN CONTENT

3.1 Concept of Health Insurance

Health Insurance is a concept designed for funding health care. It is defined as a form of prepayment plan for one's health care, a health scheme used as a buffer against unpredictable and unexpected health crisis which would have cost the person a fortune. It provides medical services when required by an insured person and provides the ability

to get health services when required without having to pay fully at the time of need either because payment has previously been made by regular contributions by the insured or his/her employer or both.

3.2 Objectives of Health Insurance

1. Providing a service from which individuals gain and they are willing to pay.
2. Providing for a fairer distribution of the society's cost of curative health care.
3. Providing an effective means for the collection of revenue for the curative health system.
4. Reduces high cost of medical care because the victim may be financially incapacitated at the time of the payment of medical care is needed.

3.3 Types of Health Insurance Scheme

1. Hospital Expenses Protection (HEP)

This involves payment of hospital bill up to a specified period of time with specified amount of money.

2. Regular Medical Care (RMC)

This is concerned with payment for routine medical care or check-up which is done over a specified period. For instance, the doctor who gives the routine medical care is paid from time to time.

3. Loss of Income Protection (LIP)

In this case, a proportion of normal salary is paid to the person after recovery or disability for a period of time. This payment is supposed to start at a specified period during the disability and continue up to another specified period.

3.4 Agencies that Operate Health Insurance

1. Government Sponsored Agency

Government sponsor health insurance for specific group of people such as women, children, age grade, for employees. Such scheme may be compulsory or voluntary.

4. Employers of Labour

The employers of labour in order to show concern for the welfare of their workers operate health insurance scheme for their workers.

5. Commercial Insurance Companies

These group include life insurance scheme, vehicle insurance scheme etc.

6. Private or family Insurance

Individual or family can arrange or negotiate with a doctor or health worker. Payment is done accordingly as the arrangement permits.

3.5 Benefits of Health Insurance

- a) It ensures access to good health
- b) It protects families from the financial hardship of huge medical bills
- c) It limits the rise in cost of health care services
- d) It helps in distributing health care equitably among various income groups.
- e) It sets and monitors the standards of health care delivery.
- f) It ensures efficiency in the health services
- g) It ensures equitable distribution of health facilities in the country.
- h) It provides health care services to the underserved areas.
- i) It relieves anxiety for the client.
- j) It promotes job satisfaction and happiness for the employee/worker. That is caring for the workers.
- k) It gives security to the workers.
- l) It facilitates the utilization of appropriate health services. Thus the worker will not go to cheap hospitals or quacks.
- m) It facilitates the adoption of appropriate health services.
- n) It reduces the burden of payment of high cost of health care and medical care among the workers.

SELF-ASSESSMENT EXERCISE(S)

1. Define the term Health Insurance.
2. Outline the objectives of Health insurance.
3. Identify any five benefits of health insurance.

4.0 CONCLUSION

This unit described health insurance, revealing that health insurance is a prepayment plan for one's health care. The unit indicated that there are types of health insurance, which organizations and workers could adopt

and that Health Insurance could be beneficial to workers as it ensures easy access to quality health care services. Understanding the concept and benefits of health insurance becomes imperative since most workers especially, the self-employed worker, are not well informed about Health Insurance. Furthermore, the knowledge will help you plan your future as potential adult workers.

5.0 SUMMARY

This unit provided knowledge on the concept and definition of health insurance, types and agencies that operate health insurance and the benefits of health insurance. It was indicated in the unit, among others, that Health Insurance ensures access to good health by protecting families from the hardship of huge medical bills and limiting the rise in cost of health care services.

6.0 TUTOR/MARKED ASSESSMENT

- 1) Identify and discuss the various types of Health Insurance.
- 2) Describe the agencies that operate Health Insurance.

7.0 REFERENCES/FURTHER READINGS

Link to:

https://www.investopedia.com/terms/h/health_insurance.asp

https://www.merriam-webster.com/dictionary/health_insurance

https://www.pathzusa.com/meaning_of_health_insurance

MODULE 7 ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

MODULE INTRODUCTION

Environmental impact assessments are meant for the assessment of the consequences or impact of an ongoing project, programme or proposed project. It takes into account the relationships that exist between socio-economic, cultural and human health impacts. It also considers the beneficent and the adverse effects of the project or programme on the inter-related factors. This module is set to look into the concept and definition of EIA. It will also highlight the environmental sensitive areas. Environmental impact assessment is to be carried out in all economic sectors such as agriculture, airports drainage and irrigation, fisheries, forestry, housing industry, infrastructure, parts, mining, petroleum, power generation and transmission. It should be carried out also in quarries, railways, transport, resort, water supply, recreational centres and waste treatment centres.

- Unit 1 Concept and definition of EIA
- Unit 2 Environmental sensitive area

UNIT 1 CONCEPT AND DEFINITION OF EIA

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Concept of EIA
 - 3.2 Definitions of EIA
 - 3.3 Objectives of EIA
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor/Marked Assessment
- 7.0 References/Further Reading

1.0 INTRODUCTION

The cultural environmental of man influences his exploration and exploitation of the physical environment in order to survive. Because man depends on the natural resources for his survival, he exerts great impact on the environment. This creates the need to assess the impact man's activities have on the environment. This unit will discuss the concept and definition of Environmental Impact Assessments (EIAs).

2.0 OBJECTIVES

By the end of this unit, the students should be able to”

- Give the concept of EIA
- Define EIA
- State the objectives of EIA

3.0 MAIN CONTENT

3.1 Concepts of Environmental Impact Assessment (EIA)

The environment can be grouped into two, physical and cultural. The physical environment being the natural environment is comprised of biosphere, atmosphere, hydrosphere and troposphere. The cultural environment has to do with the way of life, of a set of people in a specific location. The interaction between these two groups has great implications for both. These interactions exert a negative influence, in deferent ways on man and the ecosystem. Man depends on the exploration and exploitation of the physical environment around him for his existence and his life is being influenced by his cultural environment. The earth being the source of natural resources which man depends for his well-being and also the sink where waste generate in the course of transforming the natural resources to finished products is being dumped, it leads to environmental degeneration. Whenever the rate of resources exploitation from the earth exceeds the rate at which natural resources are being produced or when the rate of waste generation exceeds the natural absorbing capacity of the earth, it generates a lot of impacts on the environment. These impacts can be.

- a) Physical and socio-economic impacts
- b) Direct and indirect
- c) Short-run and long-run
- d) Local and strategic
- e) Adverse and beneficial
- f) Reversible and irreversible
- g) .Quantitative and qualitative
- h) Actual and perceived

3.2 Definitions of Environmental Impact Assessment (EIA)

Environmental impact assessment is defined by Munn (1979) as a process for identifying the likely consequences that could arise from a developmental activity and which could have direct and indirect adverse consequences on the health of the people living in the geographical area. It is also defined as a process which attempts to identify, predict and

assess the likely consequences of proposed developmental activities. It is a process of determining the potential environmental, social and health effect of developmental activities.

3.3 Objectives of EIA

1. To protect and manage the environment for sustainable development.
2. To integrate environmental management and economic decision of an early planning stage of a programme in order to ensure that potential problems are avoided.
3. To predict the consequences of a proposed undertaking from the environment and be able to replace perceived negative undertaking with positive one.
4. To compare various alternatives which are available for a particular activity
5. To use an open, transparent and participation approach in providing avenues for the involvement of the public, private and government agencies that are interested as well as affected people in the assessment and review of the environment.

SELF ASSESSMENT EXERCISE(S)

1. Define environmental Impact Assessment.
2. State the objectives of EIA.

4.0 CONCLUSION

This unit has provided you with the knowledge that man's activities on the environment exerts great impacts that later affects the link between man's cultural environment and the natural environment. Your understanding of the contents of this until will help you in predicting the consequences of a proposed project it will also help you to integrate environmental management in the early stage of planning of a project to avoid potential problems.

5.0 SUMMARY

This unit projected the concept of EIA, definitions of EIA. The unit also discussed the objectives of EIA, indicating that to protect and manage the environment leads to sustainable environment. Environmental Impact Assessment also predicts the consequences of a proposed undertaking and compares various alternatives which are available for a particular activity.

6.0 TUTOR/MARKED ASSESSMENT

1. Give the concept of EIA.
2. Identify any five impacts that could be generated by the action of man in the environment.

7.0 REFERENCE/ FURTHER READING

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UNIT 2 ENVIRONMENTAL SENSITIVE AREAS (ESA) AND STAGES IN EIA PROCESS

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Environmental Sensitive Areas (ESAs)
 - 3.2 Stages in EIA Process
 - 3.3 Benefits of EIA
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor/Marked Assessment
- 7.0 Reference/Further Reading

1.0 INTRODUCTION

In unit one of this module, you have been exposed to the concept of EIA and the objectives. It is expected that you have understood the meaning and what it is meant for. This unit will further educate you on the sensitive areas that require EIA, the stages that are involved in carrying out EIA and the benefits of EIA.

2.0 OBJECTIVES

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

- Identify the environmental sensitive areas.
- Discuss the stages in EIA
- Mention the benefits of EIA

3.0 MAIN CONTENT

3.1 Environmental Sensitive Areas (ESA)

These are those areas known from experience and are proved to be fragile and can easily be harmed by the effects of the development. These include:

- a) Areas prone to natural disasters (flooding, rain storms volcanic, landslides, earth quake etc).
- b) Wetlands such as swamps, lakes, rivers etc
- c) Mangrove swamps characterized by adjoining mouth of major river systems; near or adjacent to traditional fishing grounds;

- made for natural buffers against share erosion.
- d) Areas susceptible to erosion.
 - e) Areas of importance to threatened cultural group.
 - f) Areas with endangered or threatened plants and animals.
 - g) Areas of unique socio-cultural history, archaeological history or scientific importance and areas with potential tourist value.
 - h) Polluted area
 - i) Areas subject to desertification and bush fire.
 - j) Coastal areas and Marine ecosystems.
 - k) Areas declared as National Parks, forest reserves, wildlife reserves and the likes.
 - l) Mountainous areas.
 - m) Areas classified as prime agricultural lands.
 - n) Public open spaces in urban areas or green belts.
 - o) Burial sites and graves.

3.2 Stages in EIA Process

S/N	STAGES	ACTIVITIES
1.	Screening	Assess need for EIA
2.	Scoping	Identify main EIA issues, determine level of detail, draft terms of references.
3.	Impact identification	Identify possible impacts of proposed activities.
4.	Assessment	Evaluate and compare impact severity and duration; quantify where possible.
5.	Mitigation and compensation measures	Design measures to mitigate adverse environmental impacts and to compensate people for environmental losses.
6.	Environmental impact statement (EIS)	Present assessment and make recommendation.
7.	EIA Review	Assess quality of the draft (EIS) in order to ensure implementation of accepted recommendation.
8.	Monitoring	Monitor impact during implementation or operation

9.	Auditing	Assess compliance of (EIS) recommendations and requirements.
10.	Decommissioning	Ensure that environment is rehabilitated after the activity ceases (after operation).

Culled from Jagannath, T. (2019)

3.3 Benefits of EIA

1. It helps to identify environmental issues that a project should address, pointing out needed corrective measures;
2. When initiated at the right stage, it minimizes delay and additional costs caused by unanticipated environmental problems during project implementation.
3. The encouragement of public participation enhances the image of public developers.
4. It enhances necessary inter-agency co-ordination and harmonious relationship between project promoters and potentially affected groups.
5. It Fosters proper considerations in project sitting, facility and process design selection.
6. It enhances the sustenance of the carrying capacity of various components of the environment in the country.
7. Prevention of litigation and future liabilities.
8. Continuous improvement in our environmental performance.
9. It creates awareness of environmental protection in the public.

SELF-ASSESSMENT EXERCISE(S)

1. Mention any ten environmental sensitive areas
2. Identify any six benefits of EIA.

4.0 CONCLUSION

You have learnt from this unit that areas prone to natural disasters, wetlands, and polluted areas are the sensitive areas for EIA. You have also learnt that EIA is done in stages, starting from screening down to decommissioning. It is therefore expected that the knowledge you have gained from this unit will help you in increasing awareness of environmental protection with regards to impact assessment of projects and programmes in your community and in the general public.

5.0 SUMMARY

The focus of this unit was to identify environmental sensitive areas. The unit equally discussed stages in EIA process and highlighted the benefits of EIA. The unit shows that EIA helps to identify environmental issues that a project should address; it enhances necessary interagency coordination and harmonious relationship between project promoters and affected project groups.

6.0 TUTOR/MARKED ASSESSMENT

1. In a tabular form describe the stages in EIA process.
2. Proffer any three reasons why EIA should be done in stages.

7.0 REFERENCES/ FURTHER READING

Link to:

<https://planningank.com/author/thejas> view all post by Thejas jagannath.

<https://planningtank.com/sustainable-development/sustainable-development-goals-united-nations>.

<https://www.cbd.int/impact/whatis.shtml> environmental

Jagannath, T. (2019). The importance of Environmental Impact Assessment (EIA). *Environment*.