NATIONAL OPEN UNIVERSITY OF NIGERIA

SCHOOL OF SCIENCE AND TECHNOLOGY

COURSE CODE: NSS 306

COURSE TITLE: ENVIRONMENTAL HEALTH AND DISEASE

COURSE GUIDE

NSS 306
ENVIRONMENTAL HEALTH AND DISEASE

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Introduction

NSS 306: Environmental Health is a two-credit course for nursing students and related disciplines

The course is broken into four modules and 13 study units. It will introduce the students to concepts of health, environment and variables of environmental health. Specifically, it will introduce students to concepts of relationship between environment and health, environmental health hazards, environmental health hazards: route of transmission, health and air pollution, water pollution and radiation. Finally, it will focus on certain environmental management techniques such as environmental health education, hazardous waste disposal, pollution prevention and environmental management in Nigeria: problems and prospects

At the end of this course, it is expected that students should be able to understand, explain and be adequately equipped to deal with issues of environmental health, and also be able to apply them to everyday experiences.

The course guide, therefore, tells you briefly what the course: NSS 306: Environmental Health, is all about, the types of course materials to be used, what you are expected to know in each unit, and how to work through the course material. It suggests the general guidelines and also emphasizes the need for self assessment and tutor marked assignment. There are also tutorial classes that are linked to this course and students are advised to attend.

What You will Learn in this Course

The overall aim of this course, NSS 306: Environmental Health is to introduce students to the variables associated with environment and health. During this course, you will learn about concepts and forms of environmental health as well as its management.

Course Aims

This course aims to give students an in-dept understanding of environmental health. It is hoped that the knowledge would equip students with the conceptual issues of environmental health.

Course Objectives

Note that each unit has specific objectives. Students should read them carefully before going through the unit. You may want to refer to them during your study of the unit to check on your progress. You should always look at the unit objectives after completing a unit. In this way, you can be sure that you have done what is required of you by the unit.

However, below are overall objectives of this course. On successful completion of this course, you should be able to:

- define environment;
- define health and diseases;
- define environmental health;
- ascertain the relationship between health and environment;
- identify environmental health hazards and routes of transmission;
- describe air and water pollution;
- describe radiation and its health implications;
- discuss environmental health education;
- describe hazardous waste disposal methods;
- discuss methods of pollution prevention; and
- discuss the problems and prospects of environmental management in Nigeria.

Working through this Course

To complete this course, you are required to read the units, the recommended textbooks, and other relevant materials. Each unit contains some self-assessment exercises and tutor marked assignments, and at some point in this course, you are required to submit the tutor marked assignments. There is also a final examination at the end of this course. Stated below are the components of this course and what you have to do.

Course Materials

The major components of the course are:

1. Course Guide
2. Study Units
3. Text Books
4. Assignment File
5. Presentation Schedule

Study Units

There are 13 study units and four modules in this course. They are:

Module 1 Environment and Health: An Introduction

Unit 1 Defining Environment
Unit 2 Defining Health and Diseases
Unit 3 Conceptualizing Environmental Health

Module 2 Relationship between Environment and Health, Environmental Health Hazards and Routes of Exposure

Unit 1 Relationship between Environment and Health
Unit 2 Environmental Health Hazards
Unit 3 Environmental Health Hazards: Route of Transmission

Module 3 Environmental Health – Air, Water and Radiation

Unit 1 Environment: Health and Air Pollution
Unit 2 Environment: Health and Water Pollution
Unit 3 Environment: Health and Radiation Pollution

Module 4 Environmental Health Education, Waste Disposal, Problems and Prospects of Environmental Management in Nigeria

Unit 1 Environmental Health Education
Unit 2 Hazardous Waste Disposal
Unit 3 Pollution Prevention in Industries
Unit 4 Environmental Management in Nigeria: Problems and Prospects

Each unit contains self-assessment exercise and tutor marked assignments, which students are required to attempt. It is believed that these exercises will assist you to achieve the learning objectives of the units.

Textbooks and References

These texts will be of immense benefit to this course:

Anijah-Obi, F. (2000). *Environmental Management in Nigeria: Problems and Prospects.* In H. I. Ajaegbu, B. J. Matthew-Daniel and O. E. Uya (Eds). *Nigeria: A people United, a Future*

Assured Vol 1(A Compendium). Federal Ministry of Information: Gubabo Pub. Co.

Anijah-Obi (1996). Environmental Crisis: An Overview. In P. Alozie (ed), *Technology, Science and Environment: A Current Overview of Nigeria***.** Aba: Vitalis Press.

Olaniran, N. S., Akpan, E. A., Ikpeme, E. E. and Udofia, G. A. (1995). *Environment and Health. (Module eleven).* Lagos: Macmillan Nigeria Pub.

Uchegbu, S. N. (2002). *Environmental Management and Protection* (second edition). Enugu: Spotlite Publishers.

Assignment File

The assignment file will be given to you in due course. In this file, you will find all the details of the work you must submit to your tutor for marking. The marks you obtain for these assignments will count towards the final mark for the course. Altogether, there are 13 tutor marked assignments for this course.

Presentation Schedule

The presentation schedule included in this course guide provides you with important dates for completion of each tutor marked assignment. You should therefore try to meet the deadlines.

Assessment

There are two aspects to the assessment of this course. First, there are tutor marked assignments; and second, the written examination. You are thus expected to apply knowledge, comprehension, information and problem solving gathered during the course. The tutor marked assignments must be submitted to your tutor for formal assessment, in accordance with the deadline given. The work submitted will count for 40 percent of your total course mark.

At the end of the course, you will need to sit for a written examination. This examination will account for 60 percent of your total score.

Tutor-Marked Assignment

There are 13 TMAs in this course. You need to submit all the TMAs. The best four will therefore be counted. When you have completed each assignment, send them to your tutor as soon as possible and make sure

that it gets to your tutor on or before the stated deadline. If for any reason you cannot complete your assignment on time, contact your tutor before the assignment is due, to discuss the possibility of an extension. Extension will not be granted after the deadline, unless on exceptional cases.

Final Examinations and Grading

The final examination of NSS 306 will be of two hours duration and have a value of 60 percent of the total course grade. The examination will consist of questions which reflect the self-assessment exercise and tutor marked assignments that you have previously encountered. Furthermore, all areas of the course will be examined. It is also better to use the time between finishing the last unit and sitting for the examination, to revise the entire course. You might find it useful to review your TMAs and comment on them before the examination. The final examination covers information from all parts of the course.

Course Marking Scheme

The following table includes the course marking scheme

Table 1 Course Marking Scheme

Assessment	**Marks**
Assignment 1-13	13 assignments, 40% for the best 4 Total = 10% X 4 = 40%
Final Examination	60% of overall course marks
Total	100% of Course Marks

Course Overview

This table indicates the units, the number of weeks required to complete them and the assignments.

Table 2: Course Organizer

Unit	Title of Work	Weeks Activity	Assessment (End of Unit)
	Course Guide	Week 1	
Module 1			
Unit 1	Defining Environment	Week 1	Assignment 1
Unit 2	Defining Health and Disease	Week 2	Assignment 2
Unit 3	Conceptualizing Environmental Health	Week 3	Assignment 3
Module 2			
Unit 1	Relationship between Environment and Health	Week 4	Assignment 4
Unit 2	Environmental Health Hazards	Week 5	Assignment 5
Unit 3	Environmental Health Hazards: Routes of Transmission	Week 6	Assignment 6
Module 3			
Unit 1	Environment: Health and Air Pollution	Week 7	Assignment 7
Unit 2	Environment: Health and Water Pollution	Week 8	Assignment 8
Unit 3	Environment: Health and Radiation Pollution	Week 9	Assignment 9
Module 4			
Unit 1	Environmental Health Education	Week 10	Assignment 10
Unit 2	Hazardous Waste Disposal	Week 11	Assignment 11
Unit 3	Pollution Prevention in Industries	Week 12	Assignment 12
Unit 4	Environmental Management in Nigeria: Problems and Prospects	Week 13	Assignment 13

How to Get the Most Out of this Course

In distance learning, the study units replace the university lecture. This is one of the huge advantages of distance learning mode; you can read and work through specially designed study materials at your own pace and at a time and place that suits you. Think of it as reading the teacher,

the study guide tells you what to read, when to read and the relevant texts to consult. You are provided exercises at appropriate points, just as a lecturer might give you an in-class exercise.

Each of the study units follows a common format. The first item is an introduction to the subject matter of the unit and how a particular unit is integrated with the other units and the course as a whole. Next to this is a set of learning objectives. These learning objectives are meant to guide your studies. The moment a unit is finished, you must go back and check whether you have achieved the objectives. If this is made a habit, then you will significantly improve your chances of passing the course. The main body of the units also guides you through the required readings from other sources. This will usually be either from a set book or from other sources.

Self-assessment exercises are provided throughout the unit, to aid personal studies and answers are provided at the end of the unit. Working through these self-tests will help you to achieve the objectives of the unit and also prepare you for tutor marked assignments and examinations. You should attempt each self-test as you encounter them in the units.

The following are practical strategies for working through this course

1. Read the course guide thoroughly.

2. Organize a study schedule. Refer to the course overview for more details. Note the time you are expected to spend on each unit and how the assignment relates to the units. Important details, e.g. details of your tutorials and the date of the first day of the semester are available. You need to gather together all these information in one place such as a diary, a wall chart calendar or an organizer. Whatever method you choose, you should decide on and write in your own dates for working on each unit.

3. Once you have created your own study schedule, do everything you can to stick to it. The major reason that students fail is that they get behind with their course works. If you get into difficulties with your schedule, please let your tutor know before it is too late for help.

4. Turn to Unit 1 and read the introduction and objectives for the unit.

5. Assemble the study materials. Information about what you need for a unit is given in the table of content at the beginning of each unit.

You will almost always need both the study unit you are working on and one of the materials recommended for further readings, on your desk at the same time.

6. Work through the unit. The content of the unit itself has been arranged to provide a sequence for you to follow. As you work through the unit, you will be encouraged to read from your set books.

7. Keep in mind that you will learn a lot by doing all your assignments carefully. They have been designed to help you meet the objectives of the course and will help you pass the examination.

8. Review the objectives of each study unit to confirm that you have achieved them. If you are not certain about any of the objectives, review the study material and consult your tutor.

9. When you are confident that you have achieved a unit's objectives, you can start on the next unit. Proceed unit by unit through the course and try to pace your study so that you can keep yourself on schedule.

10. When you have submitted an assignment to your tutor for marking, do not wait for its return before starting on the next unit. Keep to your schedule. When the assignment is returned, pay particular attention to your tutor's comments, both on the tutor marked assignment form and also written on the assignment answer sheet. Consult your tutor as soon as possible if you have any questions or problems.

11. After completing the last unit, review the course and prepare yourself for the final examination. Check that you have achieved the unit objectives (listed at the beginning of each unit) and the course objectives (listed in this course guide).

Facilitators/Tutors and Tutorials

There are eight hours of tutorial provided in support of this course. You will be notified of the dates, time and location together with the name and phone number of your tutor as soon as you are allocated a tutorial group.

Your tutor will mark and comment on your assignments, keep a close watch on your progress and on any difficulties you might encounter and your tutor will provide assistance to you during the course. You must mail your tutor marked assignment to your tutor well before the due

date. At least two working days are required for this purpose. They will be marked by your tutor and returned to you as soon as possible.

Do not hesitate to contact your tutor by telephone' e-mail or discussion board if you need help. The following might be circumstances in which you would find help necessary: contact your tutor if:

- You do not understand any part of the study units or the assigned readings.
- You have difficulty with the self test or exercise.
- You have questions or problems with an assignment, with your tutor's comments on an assignment or with the grading of an assignment.

You should try your best to attend the tutorials. This is the only chance to have face to face contact with your tutor and ask questions which are answered instantly. You can raise any problem encountered in the course of your study. To gain the maximum benefit from the course tutorials, prepare a question list before attending them. You will learn a lot from participating in discussion actively. GOODLUCK!

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MODULE 1 ENVIRONMENT AND HEALTH: AN INTRODUCTION

UNIT 1 DEFINING ENVIRONMENT

CONTENTS

1.0 INTRODUCTION

Our environment affects our health. The quality of environment in which a person lives, is thus, inextricably linked with the quality of life he or she enjoys especially his/her health and socio-economic status. Therefore, if people are to enjoy good health, the prime requisite is that they should live in a clean, safe and healthy environment that is conducive.

Man's seemingly unlimited power to dominate his environment and exploit the natural resources therein for selfish reasons, needs and desires has obscured his appreciation of the fact that he or she is but one unit, a part of 'a comprehensive system of dynamic inter-dependencies that is more than the sum of its parts' (Benarde, 1973). Thus, human activities may affect the environment while many factors in the environment may also have negative or positive impact on people's health and welfare.

In this unit, we will provide a working definition of the ‘environment’, its components and inter-relationship of such environmental components. We will also look at global environmental problems and the need to care for our environment. Happy reading!

2.0 OBJECTIVES

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

- examine definitions of environment;
- identity and describe types of environment;
- identify major components of environment;
- ascertain the inter-relationship of environmental components;
- discuss the need to care for our environment; and
- describe global environmental problems.

3.0 MAIN CONTENT

3.1 Definitions of Environment

In everyday use, the word 'environment' commonly means the 'surroundings'. We generally observe that, every organism lives amidst various living and non living things. The term ‘environment’, thus encompasses many variables and parameters which determine the existence, survival and continuance of the organism. Though the simplest meaning of the term refers only to physical and biological surroundings, its broader meaning has much wider connotations and includes social, cultural, economic, political and intellectual activities of man which affect the physical and biological components. One may conveniently regard the environment as encompassing two basic facets the biological and the socio-cultural.

Definition 1: The Longman's dictionary defines 'environment' as: The physical and social conditions in which people live especially as they influence their feelings and development. It also includes the natural conditions such as air, water, land and energy in which organisms live.

Definition 2: “Environment,” in this context, means things in the natural environment like air, water and soil, and also all the physical, chemical, biological and social features of our surroundings.

Definition 3: In other words: environment is the sum total of all conditions and influences that affect the development of all living things including man. It includes the positive and negative effects of human intervention and creation of assets or capital.

Definition 4: A conventional definition of the term 'environment' is 'immediate surroundings; all the conditions, circumstances and influences surrounding and affecting all organism or a group of organism' (McKechnie, 1983).

Definition 5: All of which that is external to individual human host. It can be divided into physical, biological, social cultural, any or all of which can influence health status in a population.

Definition 6: To an environmentalist, environment comprises the land, water, air and other physical structures observable around an organism or a group of organisms.

Definition 7: From an ecological viewpoint, environment is simply an ecosystem. An ecosystem is the basic functional unit in the ecology and the term refers to any natural or artificial environment where living things (i.e., biotic components) are interacting with non-living things (abiotic components). Thus, man as a unit within an ecosystem interacts with, and is dependent on other living things as well as the physical, chemical and socio-cultural factors in the ecosystem. Suffice to note that an ecological definition of the environment is necessary for a clearer and better understanding of the relationship of environment to human health (Olaniran, Akpan, Ikpeme and Udofia, 1995).

The following illustration is a good representation of environment:

Environment = Natural Environment + Man-made Environment + Social Environment

SELF-ASSESSMENT EXERCISE

Define environment.

3.2 Types of Environment

3.2.1 Natural Environment

The natural environment, commonly referred to simply as the environment, is a term that comprises all living and non-living things that *occur* naturally on earth or some part of it. This term includes a few key components:

1. Complete landscape units that function as natural systems without massive human intervention, including all plants, animals, rocks, etc. and natural phenomena that occur within their boundaries.

2. Universal natural resources and phenomena that lack clear-cut boundaries, such as air, water and climate.

3. Natural features which occur within areas heavily influenced by man (such as wild birds in urban gardens), (Wikipedia, 2006).

3.2.2 Man-made Environment

The natural environment is contrasted with the built environment, which comprises the areas and components that are heavily influenced by man. The man-made, or "built," environment includes physical structures where people live and work such as homes, offices, schools, farms and factories, as well as community systems such as roads and transportation systems, land use practices and waste management. Consequences of human alteration to the natural environment, such as air pollution, are also parts of the man-made environment.

3.2.3 Social Environment

The social environment encompasses lifestyle factors like diet and exercise, socioeconomic status, and other societal influences that may affect health. (Medline, 2006).

3.3 Major Components of Environment

Major components include:

Air
Water
Land
Energy
Living Organism

3.4 Inter-relationship of Environmental Components

All major components of the environment viz., Air, Water, Land, Energy and Living beings including man are inter-related and inter-connected in one way or the other.

- Living beings are dependent upon their physical environment- the land, water, air and energy for their existence. At the same time they also affect the physical components just as the changed physical conditions again have a direct impact on living beings.

- One of the fundamental aspects in ecology that helps us, understand the inter-relationship between plants and animals,

animals and animals, animals and human beings is their requirement of food. Green plants are the primary producers of food. They make simple carbohydrates during the process of photosynthesis with the help of carbon dioxide and water by the utilization of energy received from the sun. When herbivore animals eat plants, they get energy through this food. Herbivores are eaten by carnivores for their food and energy requirement and life activities. These inter-linkages account for what we call *food chains*. An interconnected network of different food chains that occur among the inhabitants of a particular natural habitat makes a *food-web*. The food-web is a delicate network of inter-relationships between the species involved, representing a balanced and self-contained living system. Destruction of any one link in this food-web has an adverse impact on the other or the entire system itself.

- Inter relationships in nature take many forms, plants and vegetation provide home for animals, insects and birds pollinate flowers, animals help the dispersal of seed of plants, parasites infest plants or animals.

- There is also the nature's clean-up crew- the crow, the eagle, the hyena and others who act as scavengers. The bacteria aid in decomposing the dead which play an important role in returning the organic and inorganic components of dead animals and plants back to nature, to be used and reused by subsequent living organisms.

- Plants take nature's raw material of earth, water, air and sunlight and organize them into living substance. But without the help of animals, plants would long ago have organized themselves out of existence, for they would have locked up in the earth the world's available supply of carbon and then died of starvation. Fortunately, the animals came along in time to eat the plants and thus release the carbon and thus, keep the cycle, functioning. The carbon not released in this way is still available to us today in the form of coal. (Cited from, http://www.education.nic.in/cd50years/q/6J/AY/toc.htm).

3.5 Why should we Care for our Environment?

In ancient times, most human settlements used to be along river banks. People lived in rural areas, the economy was agrarian and the basic needs of humans could be met directly from natural resources. Most of the human activities were in harmony with nature and did not affect natural environment adversely. With the passage of time, the human

knowledge increased and man started making efforts for leading a more comfortable life. The area of human activity expanded and trade and commerce also occupied a prominent place in human endeavors. This resulted in the formation of towns. Further on, the coming of thinkers and philosophers in different parts of the world changed human thinking from superstitious beliefs to a scientific and rational outlook. Enhancement in scientific knowledge resulted in technological advancements and hence industrial growth. Vast opportunities at industrial places have accelerated the migration of people from rural areas to big cities. The advancements in the medical field have lowered infant mortality rate and increased life expectancy. World human population thus increased at a rapid rate.

Growing urbanization, rapid industrialization, intensive cultivation, population explosion and the human desire to live a more comfortable life have degraded the 'biosphere'. The story of the ever increasing needs of materials and energy has transformed man from a 'dweller' of the environment in his early stage to it's 'moulder'. In doing so., man has not only brought in unprecedented environmental crisis but has also heightened the possibility of his own extinction from the scene. (Cited from, http://www.education.nic.in/cd50years/q/6J/AY/toc.htm). Thus, the strong need to care for our environment is much stronger now than ever to avoid unprecedented havoc around the globe and ensure continued existence of man and other living and non-living organisms.

3.6 Global Environmental Problems

The progress of man from the primitive stage to the technological stage, has brought him face to face with the global environmental problems of:

- ecological decay
- resource depletion
- environmental pollution

Some of the major environmental concerns facing the world today include:

(i) Greenhouse effect and global warming
(ii) Ozone depletion
(ii) Urbanization and its associated problems
(iv) Degradation of land
(v) Air and water pollution
(vi) Loss of biological diversity
(vii) Large scale deforestation
(viii) Depletion of natural resources
(ix) Disposal of waste

Most of these environmental problems are the consequences of the changes brought about by man's intervention with the environment for the satisfaction of his basic needs as well as his pursuit of more ambitious goals.

4.0 CONCLUSION

In this unit, the term ‘environment’ was described as natural environment like air, water and soil, and also all the physical, chemical, biological and social features of our surroundings. Also, types of environment were broadly categorized as natural, man-made and social. The inter-relationship of the environmental components was further analyzed. It was also observed that growing urbanization, rapid industrialization, intensive cultivation, population explosion and the human desire to live a more comfortable life have degraded the 'biosphere', so stories of the ever increasing needs of materials and energy has transformed man from a 'dweller' of the environment in his early stage to its 'moulder'. In doing so, man has not only brought in unprecedented environmental crisis but has also heightened the possibility of his own extinction from the scene.

5.0 SUMMARY

I hope you enjoyed this unit. Remember, we started with different definitions of environment, to types of environment, major components of environment and its inter-relationship. Finally, we looked at the need to care for the environment and also highlighted some global environmental problems. Now let us attempt the questions below.

ANSWER TO SELF-ASSESSMENT EXERCISE

“Environment,” in this context, means things in the natural environment like air, water and soil, and also all the physical, chemical, biological and social features of our surroundings. All of which that is external to individual human host. It can be divided into physical, biological, social cultural, any or all of which can influence health status in a population.

6.0 TUTOR-MARKED ASSIGNMENT

1. Identify the major components of the environment
2. Illustrate the inter-relationship between components of the environment

7.0 REFERENCES/FURTHER READINGS

Benarde, M. A. (1973). *Our Precarious Habit – An Integrated Approach to Understanding Man's Effect on his Environment.* Revised Edition. New York: W. W. Nortion and Company Inc.

Environment and School. Sourced from compilation on 50 years of Indian Education. *http://www.education.nic.in/cd50years/home.htm. Site visited on 13th June. 2007.*

Environment and Health: *MedlinePlus (2006).* (http://www.nlm.nih.gov/medlineplus/environmentalhealth.html). Site visited on 12th June, 2007. National Institute of Environmental Health Sciences.

McKecnie, J. L. (1983). *Webster's New Universal Unabridged Dictionary*. New York: Simon and Schuster.

Olaniran, N. S., Akpan, E. A., Ikpeme, E. E. and Udofia, G. A. (1994). *Environment and Health.* Nigerian Conservation Foundation: Macmillan Nigerian Publishers Limited.

Wikipedia, The Free Encyclopedia (2007). *Natural Environment. Retrieved* from http://en.wikipedia.org/wiki/Natural_environment. Page was last modified 21:02, 4 June 2007. Site visited on 7th June 2007.

UNIT 2 DEFINING HEALTH AND DISEASE

CONTENTS

1.0 INTRODUCTION

Granted that we are all well, we are likely to assume we do not need to take any special actions to keep healthy. We are unlikely to think of ourselves as ill when we have minor discomfort caused by colds or headaches, or when we feel tired or depressed. However, we all, knowingly or unknowingly, have different concepts of health that guide our behaviours. This unit, therefore, seeks to review the WHO definition of health as well as different concepts of health and disease.

2.0 OBJECTIVES

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

- summarize the who perspective of health;
- distinguish between holistic, positive and negative concepts of health;
- define disease; and
- determine transmission of Disease.

3.0 MAIN CONTENT

3.1 What is Health

The Constitution of WHO, in conformity with the Charter of the United Nations declares that the following principles are basic to the happiness, harmonious relations and security of all people:

Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

The enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being without distinction of race, religion, and political belief, economic and social isolation.

The health of all people is fundamental to the attainment of peace and security and is dependent upon the fullest cooperation of individual states. The achievement of any State in the protection of health is of value to all.

Unequal development in different countries in promotion of health, control of disease, especially communicable disease, is a common danger.

Healthy development of the child is of basic importance; the ability to live harmoniously in a changing total environment is essential to such development.

The extension to all people of the benefits of medical, psychological and related knowledge is essential to the fullest attainment of health. Informed opinion and active cooperation on the part of the public are of the utmost importance in the improvement of the health of the people.

Governments have a responsibility for the health of their people which can be fulfilled only by the provision of adequate health and social measures.

SELF-ASSESSMENT EXERCISE 1

Give a summary of the WHO perspective of Health.

3.2 Components of Health

A researcher once asked a sample of participants, ‘Is your health good, average or poor?’ When a respondent gave the answer ’good’, the researcher asked, ‘When you say your health is good, what do you mean?’ The answers could be extracted from these three dimensions of health. They are:

- A holistic dimension
- A positive dimension
- A negative dimension

You might also be wondering whether there is any advantage or disadvantage in holding one or other of these views. Below are explanations to the three perceptual dimensions of health as well as the advantages and disadvantages.

3.2.1 A Holistic Dimension of Health

A Holistic Concept of health is the belief that being healthy means being without any physical disorders or diseases and being emotionally comfortable. For example, a person who feels anxious or who has low self-esteem would, according to this concept, not be well. Likewise, a person with malaria or chickenpox is likely to label himself/herself ill. Generally, people with this view are likely to label themselves as ill when they experience a wide range of unpleasant feelings, not just physical discomfort or pain.

Advantage of Holistic Dimension of Health

- One advantage of having the holistic concept is that it tends to make people sensitive about their health. This can be an advantage because it can help them to notice symptoms more quickly than other people. They notice when something does not feel right and pay more attention to their bodies.
- It can spur people to eat healthy and live healthy.

Disadvantage of Holistic Dimension of Health

- It can lead to oversensitivity to signs and symptoms of illness. Thus, oversensitivity can lead people to believe that they are ill when they are not.
- It can lead to unnecessary worry and result in people wasting their Doctor's time.
- It can also result in people not leading a lifestyle that is good for their health, such as going to work, taking strenuous exercise and going on holiday.

3.2.2 A Positive Dimension of Health

A **positive dimension** of health is the belief that being healthy is a state achieved only by continuous effort. People with this belief take active steps to maintain their health for example, through their choice of food, by taking exercise and other activities they believe will keep them well. Such people are likely to feel responsible for their own health. They will take credit for the continued absence of disease and blame themselves if they develop symptoms. According to this view, people who do not take action to maintain their own health (for example, by 'healthy eating')

cannot be healthy — even if, at any one time, there is nothing wrong with them (Cockerham, 2003).

Advantages of Positive Dimension of Health

- One result of having a positive concept of health is that people tend to take plenty of exercise, avoid smoking and excessive intake of alcohol, and eat a balanced diet. This is likely to be advantageous to them.
- Another advantage is that if such people become ill, they are likely to adopt attitudes and behaviour that contribute to getting better. There is some evidence that the chances of surviving cancer are influenced by the attitude of the patient. People who believe they can recover and avoid feeling defeated by their illness tend to do better than those who believe that they are doomed to die.
- People with positive dimensions to health tend to be active rather than passive in relation to their own health.

Disadvantage of Positive Dimensions of Health

One disadvantage of this concept is that, by taking responsibility for their own health, people might blame themselves for their illnesses and feel guilty when they become ill.

3.2.3 A Negative Dimension of Health

A **negative dimension** of health is the view that being healthy is the absence of illness — for example, not having any symptoms of disease, pain or distress. People with this view are likely to believe that good health is normal and to take it for granted.

Advantage of Negative Dimension of Health

A person with this perspective may be less anxious about his/health.

Disadvantage of Negative Dimension of Health

A person with negative health concept believes that being healthy is by chance, while those with positive concepts take active steps to stay well.
He/she may think less of healthy habits as well as measures to live healthy.
He/she may engage in self medication because good health is taken for granted.

SELF-ASSESSMENT EXERCISE 2

Read the following replies from different people on the question 'Are you healthy'? And decide which dimension of health best fits each answer.

Answer A: 'There's nothing wrong with me, as far as I know.'
Answer B: 'I look after myself, stay fit and that sort of thing.'
Answer C: 'I feel well balanced. My body and my mind are working well together.'

Now try to decide which concept of health is closest to the way you think about your health.

3.3 Defining Disease

When we think of physical infirmities that we have had, we most often think in terms of what is wrong with our bodies biologically; for instance, a virus producing disease such as chicken pox or the flu, or a failure of the body to produce needed substances such as insulin in diabetes, or an abnormal growth as in cancer. In other words, we usually think in terms of some type of disease. This unit thus provides different definitions of disease. This will also aid the appreciation of this course. Happy reading!
Pathology is the study of diseases. The subject of systematic classification of diseases is referred to as *nosology*. The broader body of knowledge about human diseases and their treatments is *medicine*. Many similar (and a few of the same) conditions or processes can affect animals (wild or domestic). The study of diseases affecting animals is veterinary medicine.

Definition 1 A disease is a change away from a normal state of health to an abnormal state in which health is diminished

Definition 2 Disease is also a medical condition. It is an abnormality of the body or mind that causes discomfort, dysfunction, distress, or death to the person afflicted or those in contact with the person. Sometimes the term is used broadly to include injuries, disabilities, disorders, syndromes, infections, symptoms, deviant behaviours, and atypical variations of structure and function, while in other contexts these may be considered distinguishable categories.

Definition 3 Cole (1970), defined disease as specific kinds of biological reactions to some kind of injury or change affecting the internal environment of the body.

Disease thus alters the normal functioning of the body and creates a lot of anxiety for the sick person. It is also a universal phenomenon, constitutes a threat to survival and disrupts socio-economic life of people.

Definition 4 In biology, *disease* refers to any abnormal condition of an organism that impairs function. The term *disease* is often used metaphorically for disordered, dysfunctional, or distressing conditions of other things, as in *disease of society*.

3.4 Transmission of Disease

Some diseases, such as influenza, are contagious or infectious, and can be transmitted by any of a variety of mechanisms, including aerosols produced by coughs and sneezes, by bites of insects or other carriers of the disease, from contaminated water or food, etc.

Other diseases, such as cancer and heart disease are not considered to be due to infection, although micro-organisms may play a role, and cannot be spread from person to person.

4.0 CONCLUSION

When thinking about your own health, you might have realized that you use more than one of the three concepts of health, or perhaps you use all three. Do not be surprised by this. The fact that there are different perceptual dimensions of health does not mean that your attitude to health necessarily belongs to just one of them. You will probably find that you apply one concept in some situations and others on different occasions. Also, health is only possible where resources are available to meet human needs and where the living and working environment is protected from life-threatening and health-threatening pollutants, pathogens and physical hazards (WHO, 1992a)

5.0 SUMMARY

We have been able to define health as well as identify different components of health. We have also learnt different definitions of disease, as well as syndromes, transmission and social significance of disease. I hope you find them quite interesting and insightful.

ANSWER TO SELF-ASSESSMENT EXERCISE 1

A Negative dimension of health
B Positive dimension of health
C Holistic dimension

ANSWER TO SELF-ASSESSMENT EXERCISE 2

The Constitution of WHO, in conformity with the Charter of the United Nations declares that the following principles are basic to the happiness, harmonious relations and security of all people:

Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. The enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being without distinction of race, religion, political, belief, economic and social isolation. Also, the health of all people is fundamental to the attainment of peace and security and is dependent upon the fullest cooperation of individual states. The achievement of any State in the protection of health is of value to all. Unequal development in different countries in promotion of health, control of disease, especially communicable disease, is a common danger. Healthy development of the child is of basic importance; the ability to live harmoniously in a changing total environment is essential to such development. The extension to all people of the benefits of medical, psychological and related knowledge is essential to the fullest attainment of health. Informed opinion and active cooperation on the part of the public are of the utmost importance in the improvement of the health of the people. Governments have a responsibility for the health of their people which can be fulfilled only by the provision of adequate health and social measures.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define Disease.
2. Identify and briefly describe the 3 components of health. Identify the advantages and disadvantages of each component.

7.0 REFERENCES/FURTHER READINGS

Bishop, G. D. (1994). *Health Psychology: Integrating Mind and Body*. Boston: Allyn and Bacon.

Black, J.G. (1996). *Microbiology. Principles and Applications, 392-412.* Third Edition. New Jersey: Prentice Hall. Upper Saddle River
Brown L, (1993). *The new shorter English Dictionary*. Oxford: Clarendon Press.

Cockerham, W. C. (2003). *Medical Sociology*. 9th Edition. NY: Prentice Hall.

Cole, R. M. (1970), *Sociology of Medicine.* New York: McGraw-Hill Book Co.

Kendell, R. E. (1975). *The Role of Diagnosis in Psychiatry*. Oxford: Blackwell Scientific Pub: Marinker M. Why make people patients? *Journal of Medical Ethics* 1975:I:81–4.

Szasz, T. S. (1987). *Insanity – The Idea and its Consequences.* New York: John Wiley and Sons.

Taylor, S. E. (2006). *Health Psychology* (6th Edition). Los Angeles: McGraw Hill. *The British Journal of Psychiatry* (2001) 178: 490-49 © 2001
The Royal College of Psychiatrists

United Nations. (1995). *Basic Facts*. Geneva: United Nations.
WHO. (1994a) *Basic Documents.* Geneva: WHO.

UNIT 3 CONCEPTUALIZING ENVIRONMENTAL HEALTH

CONTENTS

1.0 INTRODUCTION

'If you want to learn about the health of a population, look at the air they breath, the water they drink, and the places they live' (Hippocrates, the father of medicine, in the fifth Century BC).

For many, the topic of environmental health prompts pictures of smoke stacks, pipelines, and illegal dumps polluting our air, water and soil. But environmental health involves more than just pollution that can affect one's health. So, what is environmental health? To answer this question one has to realize that environmental health can be defined along a series of interacting continuums. In the broad sense environmental health is the study of the interactions between living beings (humans, animals, plants, bacteria, etc.) and the environment (air, water, soil, sun, etc.), and the subsequent impact on health and quality of life. In this unit, we will try to provide in-dept define 'environmental health' as well as the interdependence between environment and health.

2.0 OBJECTIVES

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

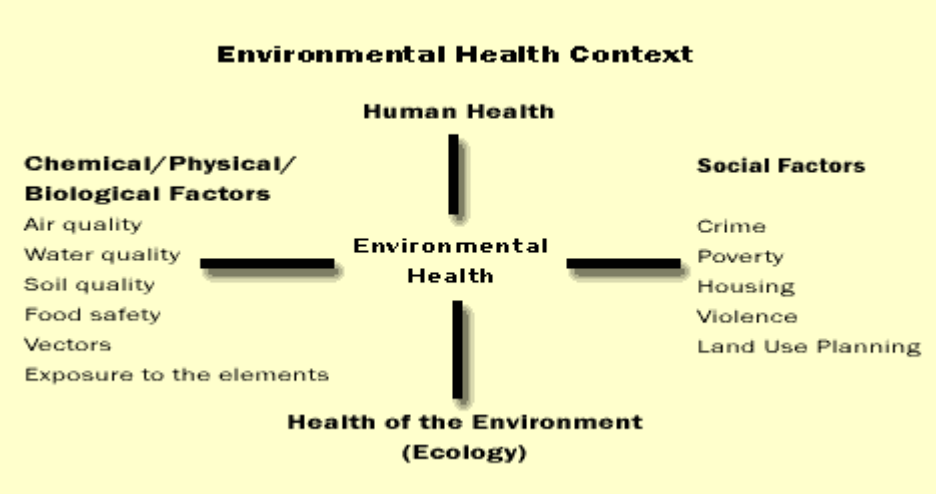
- define environmental health;
- identify goals of environmental health;
- illustrate factors that contribute to environmental health problems;
- identify the group of classes of people affected by environmental health;

- describe why environmental health is important; and
- identify how to make a difference on environmental and health.

3.0 MAIN CONTENT

3.1 What is Environmental Health?

Within this framework as illustrated in the figure below, health can be viewed from one end of the continuum, an ecological perspective, to the other end of the continuum, which focuses only on humans. The definition can also be limited to chemical, physical, and biological agents found in our air, water, food and soil or it can include social issues created by the manmade environment (violence, crime, poverty, housing, and land use planning). It is within this context that one develops a definition of environmental health.



Environmental health is thus seen as the area of Public/Community health that is primarily concerned with evaluating the relationship between environment and health. It thus seeks to prevent, control, disrupt or eliminate environmental conditions or factors inimical to human health or the environment. It includes sub-specialties like water supply and sanitation, solid waste (refuse) management, air pollution, water pollution, environmental toxicology, environmental epidemiology, radiation, health, toxic and hazardous waste management, occupational health and safety, food sanitation, noise pollution and environmental health administration. Environmental health us therefore a multifaceted and multi-disciplinary field (Olaniran et al, 1994).

The term ‘environmental health’ is also used to describe problems that arise in the relationship of the environment and health of populations within the environment.

Environmental health is also viewed the field of science that studies how the environment influences human health and disease.

Environmental health comprises those aspects of human health, including quality of life, that are determined by physical, biological, social and psychological factors in the environment. It also refers to the theory and practice of assessing, correcting controlling and preventing those factors in the environment that can potentially affect adversely the health of present and future generations (WHO, 1993a).

According to definitions of environmental health in the web, it is defined as:

- Well-being based on the health of the surrounding environment. (www.pbs.org/strangedays/glossary/E.html).

- Characteristics of health that result from the aggregate impact of both natural and man-made surroundings, including health effects of air pollution, water pollution, noise pollution, solid waste disposal, and housing; occupational disease and injuries; and those diseases related to unsanitary surroundings. (www.dph.state.ct.us/OPPE/sha99/glossary.htm).

- The interrelationships between people and their environment that promote human health and well-being and foster a safe and healthful environment. (mapp.naccho.org/MAPP_Glossary.asp).

- Environmental health is defined by the World Health Organisation as the theory and practice of assessing and controlling factors in the environment that can potentially affect health. (en.wikipedia.org/wiki/Environmental_health).

- Environmental health comprises those aspects of human health, including quality of life, that are determined by physical, chemical, biological, social, and psychosocial factors in the environment. It also refers to the theory and practice of assessing, correcting, controlling, and preventing those factors in the environment that can potentially affect adversely the health of present and future generations (http://www.who.int/phe/en/).

3.2 Goal of Environmental Health

The goal of environmental health is to prevent health problems by studying these relationships in order to:

- Identify what in the environment is causing health concerns/problems.
- Identify how and where in the environment people are being exposed to these contaminants or conditions.
- Identify what can be done to eliminate or minimize the exposure to these contaminants or conditions.
- Monitor these environmental hazards over time to ensure continued safety of the public.

The result of these activities can lead to recommendations or policy decisions that help protect both the human and ecological elements of the environment (Butler, 2003).

3.3 Factors that Contribute to Environmental Health Problems

Environmental health problems experienced today can be largely attributed to human activity and/or nature. For environmental health professionals, one of the main focus areas has been on the materials and processes used to manufacture products, whether it be food, agro-chemicals, automobiles, or household goods. During the process of converting raw materials into so many different products, many hazardous materials are used. A poorly designed product can often result in hazardous materials "accidentally" entering the environment through accidents, improper handling, storage, transportation and disposal. Human behavior and the lack of environmental health awareness can result in trash burning, illegal dumping, improper food preparation, contamination of drinking water, etc. In addition, there is an emerging trend that includes social issues as environmental health concerns. This could include how a community grows (i.e. sprawl, traffic, noise, crime, etc.) and the breakdown of social interactions among neighbors and/or communities.

While many of the above factors can be directly or indirectly tied to human behaviors, it should also be noted that there are many naturally occurring substances found in nature such as mercury, arsenic, lead, and uranium, all of which are commonly found in water. Air quality is affected by naturally occurring pollen, dust, and mold. Exposure to the elements such as the sun can affect health. In addition, there are numerous biological factors that affect health. Mosquitoes are a very common vector for the spread of disease and most food born illnesses

are the result of naturally occurring pathogens (i.e. salmonella, shigellosis, giardia, etc.). The following table captures many of the environmental health factors mentioned that contribute to these environmental health problems.

Air quality indoor/outdoor Industry air pollution Trash/wood burning Dust (field plowing/roads) Burning (fields and ditches) Pollen and molds Cigarettes Automobile exhaust VOC **Soil quality** Salts Oil and auto products Erosion Industrial pollutants (heavy metals, etc) **Waste disposal** Sewage Solid waste Access to facility Location	**Water quality drinking/ground/surface** Industrial water pollution Agricultural pesticides and fertilizers Sewage disposal (septic systems) Chemical spills Water treatment Gas storage and tank leakage Natural sources such as Fluoride, Arsenic, and Salt Automobile (oil, radiator fluid, etc) **Pesticide exposure** Work place Home Other Vectors Rodents Insects (mosquitoes, flies, etc)	**Hazardous materials** Handling Disposal Storage Transportation Food safety Restaurants Home Wildlife - fish/game Supply **Social issues** Violence Crime Land use planning Recreation Urban sprawl Housing Transportation

3.4 Who is affected by Environmental Health?

- Everyone is affected by environmental health issues in one way or another, but some groups are more sensitive than others.
- For example, environmental health hazards pose serious risks to unborn fetus because they can disrupt the development of the baby in-uterus.
- Young children are also affected more than adults because their organs are not fully developed and they breathe, eat and drink larger amounts per body weight than adults.
- The elderly are also at increased risk to environmental influences because overall, their systems do not function at the same capacity as they did when they were younger.
- Also, depending on the type of job that a person holds, there are certain groups that are exposed to a lot more hazardous materials than the general public (i.e. mining, farming, construction). Unfortunately, since the beginning of the post World War II era, there has been a growing number of individuals who have developed multiple chemical sensitivity, or severe susceptibility to any contact with chemicals agents in the environment (Butler, 2003).

SELF-ASSESSMENT EXERCISE

i. Define environmental Health
ii. Identify goals of environmental health

3.5 Why is Environmental Health Important?

- The study of environmental health has improved our understanding of the role that we play in the health of the planet.

- For instance, as a result of environmental health efforts and several catastrophic events, numerous materials used to process goods and services have been completely removed from the market.

- In other cases handling and disposal techniques have been improved to reduce environmental contamination and improve worker safety.

- In Nigeria, knowledge of environmental health is crucial because there are many environmental health hazards created from decades-old mining activities; oil explorations, contaminated water and solid waste and disposal of nuclear and hazardous waste; pesticide exposure to farm workers and their families; solid and hazardous waste dumps, and other destructive industries (Butler, 2003).

3.6 How to Make a Difference

- As community members it may feel overwhelming to think about all of the existing and potential environmental health hazards around us, but there are things we can do. Below is a list of some of the steps that can be taken to improve the environmental status of our communities.

- Become familiar with the environmental health issues by contacting environmental health groups in your area. If there are not any, consider starting one up.

- Identify potential polluters in and around your community and develop ways to monitor their activities.

- Learn about the common hazards found where you live, work and play.

- Learn about and use of safe alternatives to common hazardous household products.

- Learn about how to protect your family from food borne illnesses, indoor air quality problems, fire hazards, household hazardous materials, etc.

- Read safety labels and Material Safety Data Sheets to learn about health hazards and proper handling and disposal procedures.

- Keep polluting industries accountable to the public by monitoring their activities.

- Monitor the public notices in your community to ensure that all proposed business activity in your area receives the public scrutiny early in the process.

- Elect Public officials that will support legislations that protect the health of communities and the environment (Butler, 2003)

4.0 CONCLUSION

In this unit, we conceptualized environmental health as public/community health that is primarily concerned with relationship between the environment and health. Thus, the goal of environmental health is to prevent problems by studying these relationships in order to identify environmental hazard, as well as routes of exposure. In looking at factors that contributes to environmental health, we observed that several human activities as well as natural factors could be viewed as risk factors. We also saw that everyone is affected by environmental health problems but a special category of people like children, unborn babies, elderly, etc., could be more vulnerable to such health hazards.

5.0 SUMMARY

In this unit, we gave a broad overview of environmental health, identified its goal and factors that could contribute to environmental health problems. We further attempted to identify the group of people most vulnerable to environmental health problems, illustrate the importance of environmental health and lastly, describe how to make a difference on environment and health. Now let us attempt the following tutor marked assignment.

ANSWER TO SELF-ASSESSMENT EXERCISE

1. Environmental health is thus seen as the area of Public/Community health that is primarily concerned with evaluating the relationship between environment and health. It thus seeks to prevent, control, disrupt or eliminate environmental

conditions of factors inimical to human health or the environment. It includes sub-specialties like water supply and sanitation, solid waste (refuse) management, air pollution, water pollution, environmental toxicology, environmental epidemiology, radiation, health, toxic and hazardous waste management, occupational health and safety, food sanitation, noise pollution and environmental health administration. Environmental health us therefore a multifaceted and multi-disciplinary field.

2. The goal of environmental health is to prevent health problems by studying these relationships in order to: Identify what in the environment is causing health concerns/problems. Identify how and where in the environment people are being exposed to these contaminants or conditions. Identify what can be done to eliminate or minimize the exposure to these contaminants or conditions. Monitor these environmental hazards over time to ensure continued safety of the public.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define Environmental health
2. Illustrate factors that contribute to environmental health problems
3. Describe how to make a difference on environment and health

7.0 REFERENCES/FURTHER READINGS

Butler, J. (2003). *What is Environmental Health and why is it Important in New Mexico.* The gfr report. Retrieved from http://www.nmenvirolaw.org/news/gfrsummer03/index8.03.htm. Site visited on 27 June, 2007.

Moeller, Dade W. (1992). "*Environmental Health*." Harvard University Press, Cambridge Massachusetts.

Robinson, A. (2001). *Introduction to Environmental Health.* Retrieved from http://www.pitt.edu/~super1/lecture/lec46 51/001.htm Site visited on 7th June, 2007.

Olaniran, N. S., Akpan, E. A., Ikpeme, E. E. and Udofia, G. A. (1994). *Environment and Health.* Nigerian Conservation Foundation: Macmillan Nigerian Publishers Limited.

Yassi, A., Kjellstrom, T., de Kok, T., and Guidotti, T. (2001*).* "*Basic Environmental.*" Oxford University Press for the World Health Organization.

Wikipedia, The Free Encyclopedia, (2007). *Environmental Health,* Retrieved from http://en.wikipedia.org/wiki/Environmental_health. Page was last modified 14:28, 26 May 2007. Site visited on 7th June 2007.

Wikipedia, The Free Encyclopedia (2007). *Natural Environment*. Retrieved from http://en.wikipedia.org/wiki/Natural_environment. Page was last modified 21:02, 4 June 2007. Site visited on 7th June 2007.

MODULE 2 RELATIONSHIP BETWEEN ENVIRONMENT AND HEALTH, ENVIRONMENTAL HEALTH HAZARDS AND ROUTES OF EXPOSURE

UNIT 1 RELATIONSHIP BETWEEN ENVIRONMENT AND HEALTH

CONTENTS

1.0 INTRODUCTION

Childhood and maternal underweight, high blood pressure, high cholesterol, unsafe water sanitation and hygiene, indoor smoke from solid fuels, tobacco and alcohol are the leading causes of the global burden of disease. It is estimated that 25-33% of such disease is attributable to environmental factors (WHO, 2002) though this varies considerably between regions of the world (Lancet, 2002), with 'lifestyle' factors such as tobacco, high blood pressure, alcohol, high cholesterol and physical inactivity dominating the developed regions. In this unit, we will look at the relationship between environment and health. Specifically, we will look at the impact of various environmental components like air, water, radiation, food, etc. on health.

2.0 OBJECTIVES

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

- illustrate the relationship between air pollution and health;
- illustrate the relationship between water pollution and health;
- describe food borne diseases and it effects on health;
- ascertain the relationship between radiation and health;
- ascertain the health effects of electromagnetic fields;
- describe the effect of chemicals of health;
- explain the effect of poor waste management on health; and
- describe the influence of climatic change on health.

3.0 MAIN CONTENT

3.1 Relationship between Environment and Health

3.1.1 Air Pollution and Health

Air pollution is a major concern for all age groups. Three major groups of air pollutants are:

- Particulates
- Ozone
- Heavy metals.

Air pollution is described as changes in the surface-air temperature, referred to as the global temperature, brought about by the greenhouse effect which is induced by emission of greenhouse gases into the air. This leads to allergies and asthma, skin cancer and the contribution to global warming. Global warming is thus described as changes in the surface-air temperature, referred to as the global temperature, brought about by the greenhouse effect which is induced by emission of greenhouse gases into the air.

Transport is the dominant source of air pollution in urban areas, with a large part of the urban population still being exposed to excesses of ambient quality levels for one or more pollutants: particulate matter (PM), nitrogen dioxide, benzene and ozone (EEA, 2002).

3.1.2 Water and Health

Worldwide, insufficient water quality and supply, sanitation and hygiene are believed to be the second biggest cause, after malnutrition, of loss of potentially healthy years of life due to death and illness.

A number of serious infectious diseases, such as hepatitis A, cholera and typhoid fever, can be spread via contaminated drinking water, as can more common intestinal diseases such as gastroenteritis. It is estimated that there are about 4 billion cases worldwide of diarrhoea per year, resulting in 2.2 million deaths (WHO, 2002).

The linkage between water supply, sanitation, hygiene and health is important. In a household without tap water it is difficult to make a flushing toilet work properly, if at all, and it is a demanding exercise to keep personal hygiene, the cleanliness of the dwelling and clothes at a satisfactory level. Hygiene, well-being, and consequently health, are at serious risk.

Recreational water environments have a diverse range of hazards to human health. These include factors associated with microbial pollution, accidents, exposure to toxic algae products, occasional exposure to chemical solution and sunburn.

3.1.3 Foodborne Diseases and Health

Disease

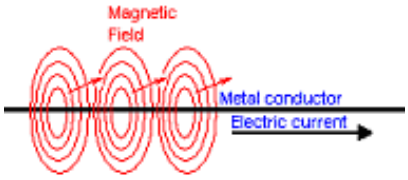
Food-borne diseases caused by microbial hazards are a growing public health problem. Most countries with systems for reporting food-borne diseases have documented significant increase during each period in the incidence of diseases caused by micro-organisms in food including Salmonella and Campylobacter.

New hazards have emerged in the food chain such as enterohaemorrhagic E.coli, multi-drug-resistant Salmonella typhimurium and bovine spongiform encephalopathy linked to exposure to BSE.

3.1.4 Radiation and Health

It is generally (and cautiously) assumed that the effect of radiation on health is proportional to the dose received.

Health and Electro Magnetic Fields



Electro Magnetic Fields

Electromagnetic fields (EMF) can be broadly divided into: static and low-frequency electric and magnetic fields (ELF). Common sources of ELF include: High-frequency or radio-frequency fields (RF). Exposure to the public to EMF is large and increasing, so even small health impacts could be of significant public health interest.

3.1.5 Chemicals and Health

Chemicals, whether anthropogenic, from different points along the life cycle of a product or in foods, or naturally present in the environment at high concentrations, can have many different health effects.

The trends in health effects from chemicals are difficult to gauge, although many scientific papers on their potential hazards to human health have been published during recent decades.

3.1.6 Waste and Health

Efficient disposal of wastes is one of the basic requirements for people's well being. Waste disposal (including collection, transport, treatment and final disposal) is therefore an important environmental health issue.

3.1.7 Climate Change and Health

Some characteristics of global environmental issues are their multi-causality and their extensive and delayed direct and indirect effects. The potential consequences of climate change include: changes in ecosystems may affect the growth, transmission and activity of vector-borne or infectious diseases, such as malaria and dengue fever. Human health is likely to be adversely affected, either directly or indirectly, through complex interactions of ecological systems.
The direct effects may result from changes in exposure to thermal extremes, and be expressed by an increase in heat-related disease and death, but also by a decrease in cold-related disease.

4.0 CONCLUSION

This unit took a broad look at relationship between environment and health. Observations indicate that a healthy environment is a healthy nation, while unhealthy man-made or natural activities have impact on the health and well-being of people in a given environment.

5.0 SUMMARY

Specifically, this unit had a cursory look of the following environmental variables vis a vis its impact of health: air pollution, water, food-borne diseases, radiation, chemical, waste and climatic change. Hope you enjoyed reading through this unit. Now, let us attempt the questions below.

6.0 TUTOR-MARKED ASSIGNMENT

Illustrate the relationship between air, water pollution and the environment

7.0 REFERENCES/FURTHER READINGS

Epaedia, Environment Explained. Retrieved from http://epaedia.eea.europa.eu/index.php. Site visited on 27th June, 2007.

Weinhold, B. (2007). *Air Pollution and Inflammation. Environmental Health Perspectives,* Vol. 115, Number 7, July, 2007.

Wijen, F. and Pieters, J. (2005). *A Handbook of Globalisation and Environmental Policy* Northampton, MA:Edward Elgar.

Aral, M. M., Brebbia, C. A., Maslia, M. L. and Sinks, T. (2005). *Environmental Exposure and Health*. Billerica, MA:WIT Press, 2005.

EEA Report No. 10. (2005). *Environment and Health.* Copenhagen: Publications of the European Communities.

Olaniran, N. S., Akpan, E. A., Ikpeme, E. E. and Udofia, G. A. (1995). *Environment and Health. (Module eleven)* Lagos: Macmillan Nigeria Pub.

UNIT 2 ENVIRONMENTAL HEALTH HAZARDS

CONTENTS

1.0 INTRODUCTION

Examples of human activities presented in module 1 indicate that, man's ability to tinker with or dominate his or her environment has obvious consequences. One of such is the creation of environmental agents capable of impacting on human and the environment. In this unit, we will look at environmental hazards, it definitions, types and classifications.

2.0 OBJECTIVES

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

- define environmental hazard;
- ascertain the misconceptions about the meaning of hazards;
- describe environmental media; and
- illustrate different classifications of environmental health hazard.

3.0 MAIN CONTENT

3.1 Environmental Hazards: Definition

'**Environmental hazard**' is a generic term for any situation or state of events which poses a threat to the surrounding environment. This term incorporates topics like pollution and natural hazards such as storms and earthquakes.

An environmental hazard is also any substance, agent, equipment, object, human behaviour or factor that is capable of injury, disability,

disease or death in humans or has the potential for polluting or degrading the environment (Olaniran et al, 1995).

3.2 Misconception about the Meaning of Hazard

Some misconceptions about the meaning of 'hazard' should be cleared. The word 'hazard' is not synonymous with injury or disease. A hazard is only capable of causing injury if and only if certain environmental conditions exist. Few examples are given to illustrate this point.

- A parked vehicle is a hazard but will not cause harm until it is recklessly driven by a drunk driver or there is a break failure.
- Injury from a sharp, pointed object (a knife) can only occur of there is an accident through misuse or carelessness.
- A big polythene bag appears harmless but very hazardous to children if they are left unchecked. It can lead to suffocation and death.
- Human faeces (excreta) a very hazardous waste, cannot cause ill-health unless a person ingest water and food contaminated with faeces.

It must therefore be emphasized that hazard is not an injury or a disease although the terms are usually erroneously used interchangeably (Olaniran, et al, 1995).

SELF-ASSESSMENT EXERCISE

Complete the following:

A needle is a hazard but will not cause harm until ----------
A stone is a hazard but will not cause harm until ----------
A fuel is a hazard but will not cause harm until ----------
Try to come up with other examples.

3.3 Environmental Media

Exposure by individuals to environmental health hazards is normally through a medium. Exposure can be by inhalation through the nose, ingestion by mouth or absorption through the skin. Thus, the pathway in the environment through which hazards must pass before impacting on human health are collectively known as environmental media (Olaniran, et al, 1995).The environmental media are:

- The air we breath
- The food we eat
- The water we drink

- The soil which we cultivate
- Inanimate objects in our environment
- Occupation and Socio-cultural events

3.4 Classifications of Environmental Health Hazards

Environmental health hazards can be classified into 4 broad groups depending on nature and type. The groups are:

- Physical
- Biological
- Chemical
- Socio-cultural/Psychosocial

Most of the physical hazards are easily observable, detectable and measurable and are found in our immediate surroundings, but mainly in the occupational and home environment.

Some of the biological hazards cannot be seen by the naked eyes, but most are present in all components of environment. Biological hazards are detectable and measurable using microbiological or biological techniques.

Chemical hazards are the most numerous and complex. Most are found in the workplace and are measurable using sophisticated labouratory techniques.

Socio-cultural hazards are the most difficult to detect and measure because they are usually ill-defined attributes of man. Examples of hazards in each of the 4 groups are thus presented below:

Table 1
Classification of Environmental Health Hazards

<table>
<tr><th></th><th>Physical</th><th>Biological</th><th>Chemical</th><th>Socio-Cultural/Psychosocial</th></tr>
<tr><td>1</td><td>Noise</td><td>1 Pathogens(bacteria, Virus, protozoa)</td><td rowspan="2">1 Pesticides
Fungicides
Herbicides and
Inorganic fertilizer</td><td>1 Poverty</td></tr>
<tr><td>2</td><td>Dust</td><td rowspan="3">2 Sewage</td><td rowspan="2">2 Cultural beliefs and Practices
Religious beliefs and Practices</td></tr>
<tr><td>3</td><td>Heat</td><td>2 Heavy metals (lead, mercury)</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Cold</td><td rowspan="2">3 Disease Vectors (Mosquitoes,tsetsefly blackfly)
4 Vemon snakes</td><td>3 Acids</td><td>3 Education</td></tr>
<tr><td>5</td><td>Vibration</td><td rowspan="2">4 Bases
5 Asbestors</td><td>4 Occupation</td></tr>
<tr><td>6</td><td>Pressure</td><td>5 Bees</td><td>5 Lifestyle</td></tr>
<tr><td rowspan="2">7</td><td rowspan="2">Ionizing Radiation</td><td>6 Scorpions</td><td rowspan="3">6 Gases carbon monoxide, sulphur dioxide, ammonia)</td><td>6 Unhealthy habits (smoking, sexual promiscuity,</td></tr>
<tr><td rowspan="2">8</td><td rowspan="2">Open Refuse Dump</td><td rowspan="2">7 man</td><td>7 Drug abuse</td></tr>
<tr><td>9</td><td>Motor Vehicle</td><td>8 Stress, marital problems</td></tr>
</table>

4.0 CONCLUSION

This unit looked at environmental health hazards and associated variables. In this unit, we conceived hazard as is a ‘generic term for any situation or state of events which poses a threat to the surrounding environment’. We also illustrated that a hazard is only capable of causing injury if and only if certain environmental conditions exist. This unit also identified various environmental media which is generally perceived as the pathway in the environment through which hazards must pass before impacting on human health. Finally, environmental health hazards were further classified into: physical, biological, chemical and socio-cultural/psychosocial.

5.0 SUMMARY

Hope you enjoyed reading through this unit. This unit took a broad look at the meaning and misconceptions of environmental hazard, as well as environmental media and classifications of environmental health hazards. Now let us attempt the questions below.

6.0 TUTOR-MARKED ASSIGNMENT

Identify the four main classes of environmental health hazard and give examples of each.

7.0 REFERENCES/FURTHER READINGS

Olaniran, N. S., Akpan, E. A., Ikpeme, E. E. and Udofia, G. A. (1995). *Environment and Health (Module 11).* Nigerian Conservation Foundation, Lagos: MacMillan Nigeria

Weinhold, B. (2007). *Air Pollution and Inflammation. Environmental Health Perspectives*, Vol. 115, Number *7, July, 2007.*

Wijen, F. and Pieters, J. (2005). *A Handbook of Globalisation and Environmental Policy.* Northampton, MA:Edward Elgar.

Aral, M. M., Brebbia, C. A., Maslia, M. L. and Sinks, T. (2005). *Environmental Exposure and Health.* Billerica, MA:WIT Press, 2005.

UNIT 3 ENVIRONMENTAL HAZARD: ROUTE OF EXPOSURE

CONTENTS

1.0 INTRODUCTION

We all know what it means to be “exposed” to something like a cold or flu. Everyday our bodies are exposed to all sorts of environmental hazards such as bacteria, viruses, and the sun’s ultra-violet (UV) rays. Some of these hazards exist naturally and some of them are the result of human activities. There are many possible sources of hazards such as cars, industry, even volcanic eruptions. In order for us to be exposed, however, the hazard has to get from the source to us. To do this, it travels along an environmental pathway**.** In this unit, we will first identify environmental pathways, then the 3 main routes of exposure, dose, duration and frequency of exposure.

2.0 OBJECTIVES

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

- identify environmental pathways and routes of exposures;
- describe dose/response in relation to environmental hazards;
- determine individual susceptibility to environmental health hazards; and
- illustrate risk and benefits of environmental hazards.

3.0 MAIN CONTENT

3.1 Environmental Pathway

Pathways include the air we breathe, the water we drink, the food we eat, and even the soil we work in, play in, and use to grow much of our food.

3.2 Environmental Hazard: Routes of Exposure

Environmental health scientists use the term exposure to describe the total amount of a hazard that comes in direct contact with your body. Once you have come into contact with a hazard, it can get into your body through different routes.

You can breathe it in (**inhalation**). You can eat or drink it (**ingestion**). You can get it directly on your skin or in your eyes (**dermal absorption**). You can also get it directly into your body through an injection. Inhalation, ingestion, and dermal absorption are the three main **routes of** exposure.

- Inhalation: breathing – When chemicals enter the body through this route of exposure, they can get stucked in the lung and/or be taken up into the blood stream.
- Ingestion: swallowing – (usually by eating or drinking). When chemicals enter the body through this route of exposure, they can easily be taken up into the blood stream (Jackson, 2005)
- Dermal Absorption: Absorbing a chemical through any part of the skin, including the eyes. When chemicals come in contact with the skin, they can sometimes enter the bloodstream through this route of exposure. However for many chemicals, the skin provides good protection of the body.

SELF-ASSESSMENT EXERCISE

Environmental health scientists use the term exposure to describe ……

3.3 Dose/Response

This is described as the total amount of chemical that gets into human or other living things relative to the individual's body weight. Imagine that someone has been exposed to a hazardous chemical through one of the three possible routes of exposure. They have now received a **dose** of that chemical. Dose is the amount of the hazard that actually enters your body. The amount someone gets into their body (their dose) depends on many factors, including how long you are exposed, how often you are

exposed and how big or small you are. For instance, if someone is exposed over a long period of time to a hazard, their dose will be larger. For example, 30 minutes spent under the bright summer sun would give you a much smaller dose of UV rays than 4 hours spent under the sun. This is called the **duration of exposure**.

The **frequency of exposure** can also influence the dose. If someone works in a factory and is exposed to a chemical every day at work, their dose might be larger than someone who is only exposed once.

Dose can also depend on how big or small you are. When a doctor prescribes a medication for you, he or she calculates the amount of the medicine you should have based on your body size. The doctor can then give you the correct dose of the medicine for your body weight. While a teaspoon of medicine might be right for an adult, it may be far too large of a dose for an infant. The dose you receive can influence how your body responds to a hazard. For most hazards, the larger the dose, the more extreme the **response** will be. The smaller the dose, the more mild the response will be. Drinking one can of a caffeinated soda might be fine. Drinking three cans in a row may make you jittery. Drinking five cans of soda might make you feel light-headed and sick (Jackson, 2005).

3.4 Individual Susceptibility

Some people are more likely than others to get sick when they are exposed to environmental hazards. This might be because of their *genetics, body size, age, gender or general health.* This is called their **individual susceptibility**. For example, some people are more likely than others to get sick when they are exposed to certain kinds of pesticides, just because of their genes. We all know that genes help determine things like hair color and eye color, but they also lead to some important (and invisible) differences in the way bodies work. It turns out that some people have a more extreme response to certain pesticides because of their genes. These people are said to be more “individually susceptible” to pesticide poisoning. Someone who lives or works on a farm where pesticides are sprayed might want to know how susceptible he or she is in order to avoid exposure and stay healthy (Jackson, 2005)

3.5 Environmental Health Hazards: Risks and Benefits

We live in an industrial society that depends on the use of both natural and human-made chemicals to function. The use of these chemicals results in **benefits** to society as well as **risks**. Pesticides, for example, make it easier to grow fruits. Unfortunately, in some cases, pesticides can make people sick. Most of us have heard that we can reduce the risk of getting sick without giving up the health benefits that fruit offers by washing or peeling the fruit before we eat it. Scientific researchers and

government officials measure the risks and benefits that we face when we manufacture or use certain products. They work to explain what they have learned to the public and create safety standards that help people protect themselves from unnecessary risk. Their goal is simple – to help us enjoy the greatest benefits from the products that we manufacture, while exposing ourselves to the least possible risk. By understanding the risks and benefits that we face each day, we can make decisions that reduce our risk and keep us as safe and healthy as possible.

4.0 CONCLUSION

This unit served as a continuation of the previous on. Specifically, it tackled environmental hazards – routes of exposure. Inhalation, ingestion and dermal absorption were thus identified as major routes of exposure. This unit further illustrates dose exposure as the amount of the hazard that actually enters your body, in relation to body weight and size, while frequency of exposure can also influence the dose. If someone works in a building site and is exposed to a chemical every day at work, their dose might be larger than someone who is only exposed once. Furthermore, the fact that some people are more likely than others to get sick when they are exposed to environmental hazards was also illustrated. Ironically, the use of these chemicals results in benefits to society as well as risks. Pesticides, for example, make it easier to grow fruit. Unfortunately, in some cases, pesticides can make people sick.

5.0 SUMMARY

Hope you found this unit helpful. This unit identified various routes of exposure to environmental health hazards, dose and response, individual susceptibility and finally the risk and benefit of environmental health hazards. Now let us, as usual attempt the tutor marked assignment below.

6.0 TUTOR-MARKED ASSIGNMENT

Identify and describe the routes of exposure of environmental health hazards

7.0 REFERENCES/FURTHER READINGS

E. Jackson, (2005). *Chemical Hygiene*. DePaul: Office of Risk Management and Environmental Health and Safety.

MODULE 3 ENVIRONMENTAL HEALTH – AIR, WATER AND RADIATION

Unit 1 Environment, Health and Air Pollution
Unit 2 Environment, Health and Water Pollution
Unit 3 Environment, Health and Radiation Pollution

UNIT 1 ENVIRONMENT: HEALTH AND AIR POLLUTION

CONTENTS

1.0 INTRODUCTION

Recall that air pollution and other environmental health variables were briefly highlight in previous units, this unit however provides broader and in-dept review of air pollution.

Air supplies us with *oxygen* which is essential for our bodies to live. Air is 99.9% nitrogen, oxygen, water vapor and inert gases. Human activities can release substances into the air, some of which can cause problems for humans, plants. In this unit, we will look at the health effects of air pollution. Happy reading!

2.0 OBJECTIVES

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

- define air pollution;
- describe indoor pollution;
- describe outdoor pollution;
- identify major air pollutants;
- discuss health effects of air pollution; and
- identify population at risk for air pollution.

3.0 MAIN CONTENT

3.1 What is Air Pollution?

Air pollution is the contamination of air by the discharge of harmful substances. Air pollution can cause health problems including burning eyes and nose, itchy irritated throat, and breathing problems. Some chemicals found in polluted air can cause cancer, birth defects, brain and nerve damage, and long-term injury to the lungs and breathing passages in certain circumstances. Above certain concentrations and durations, certain air pollutants are extremely dangerous and can cause severe injury or death.

Air pollution can also damage the environment and property. Trees, lakes, and animals have been harmed by air pollution. Air pollution has thinned the protective ozone layer above the Earth. Air pollution can damage buildings, monuments, statues, and other structures.

Air pollution also can result in haze, which reduces visibility in national parks and elsewhere, and can sometimes interfere with aviation.

3.2 Outdoor Air Pollution

Smog is a type of large-scale outdoor pollution. It is caused by chemical reactions between pollutants derived from different sources, primarily automobile exhaust and industrial emissions. Cities are often centers of these types of activities, and many suffer from the effects of smog, especially during the warm months of the year.

For each city, the exact *causes* of pollution may be different. Depending on the geographical location, temperature, wind and weather factors, pollution is dispersed differently. However, sometimes this does not happen and the pollution can build up to dangerous levels. A **temperature inversion** occurs when air close to the earth is cooler than

the air above it. Under these conditions the pollution cannot rise and be dispersed. Cities surrounded by mountains also experience trapping of pollution. Inversion can happen in any season. Winter inversions are likely to cause particulate and carbon monoxide pollution. Summer inversions are more likely to create smog.

The **Greenhouse Effect,** also referred to as global warming, is generally believed to come from the build up of carbon dioxide gas in the atmosphere. *Carbon dioxide* is produced when fuels are burned. Plants convert carbon dioxide back to oxygen, but the release of carbon dioxide from human activities is higher than the world's plants can process. The situation is made worse since many of the earth's forests are being removed, and plant life is being damaged by acid rain. Thus, the amount of carbon dioxide in the air is continuing to increase. This buildup acts like a blanket and *traps heat* close to the surface of our earth.

Ozone depletion is another result of air pollution. Chemicals released by our activities affect the *stratosphere*, one of the atmospheric layers surrounding earth. The ozone layer in the stratosphere protects the earth from harmful *ultraviolet radiation* from the sun. Release of *chlorofluorocarbons* (CFC's) from aerosol cans, cooling systems and refrigerator equipment removes some of the ozone, causing "holes"; to open up in this layer and allowing the radiation to reach the earth. Ultraviolet radiation is known to cause skin cancer and has damaging effects on plants and wildlife.

3.3 Indoor Air Pollution

Many people spend large portion of time indoors - as much as 80-90% of their lives. We work, study, eat, drink and sleep in enclosed environments where air circulation may be restricted. For these reasons, some experts feel that more people suffer from the effects of indoor air pollution than outdoor pollution.

Indoor air pollution is the presence of excessive levels of air contaminants inside a home or building from sources such as cigarette smoking, fuel combustion for heating or cooking, certain wallboards, carpets, or insulation as well as the geology of the area (radon in soil or rocks beneath the structure). Emissions are more likely to accumulate in structures having limited air exchange with the outside. Many air pollutants typically have higher concentrations indoors than outdoors.
Other sources of indoor air pollution also includes: tobacco smoke, cooking and heating appliances, and vapors from building materials, paints, furniture, etc. cause pollution inside buildings.

Pollution exposure at home and work is often greater than outdoors. Both indoor and outdoor pollution need to be controlled and/or prevented.

3.4 What are the Major Air Pollutants?

Carbon Monoxide (CO) is an odorless, colorless gas. After being inhaled, CO molecules can enter the bloodstream, where they inhibit the delivery of oxygen throughout the body. Low concentrations can cause dizziness, headaches, and fatigue; high concentrations can be fatal.

CO is produced by the incomplete burning of carbon-based fuels, including gasoline, oil, and wood. It is also produced from incomplete combustion of natural and synthetic products, such as cigarette smoke. It can build up in high concentrations in enclosed areas such as garages, poorly ventilated tunnels, and even along roadsides in heavy traffic.

Carbon Dioxide (CO_2) is the principal greenhouse gas emitted as a result of human activity (e.g., burning of coal, oil, and natural gas). CO_2 can cause burns, frostbite, and blindness if an area is exposed to it in solid or liquid form. If inhaled, it can be toxic in high concentrations, causing an increase in the breathing rate, unconsciousness, and death.

Chlorofluorocarbons (CFCs) are chemicals used in great quantities in industry, for refrigeration and air conditioning, and in consumer products. CFCs, when released into the air, rise into the stratosphere (a layer of atmosphere high above the Earth). In the stratosphere, CFCs take part in chemical reactions that result in reduction of the stratospheric ozone layer, which protects the Earth's surface from the sun. Reducing the release of CFC emissions and eliminating the production and use of ozone-destroying chemicals is very important to the Earth's stratosphere.

Hazardous Air Pollutants (HAPs) are chemicals that cause serious health and environmental effects. Health effects include cancer, birth defects, nervous system problems, and death due to massive accidental releases, such as the disaster that occurred at a pesticide plant in Bhopal, India.

Hazardous air pollutants are released by sources such as chemical plants, dry cleaners, printing plants, and motor vehicles including cars, trucks, buses, planes.

Lead is a highly toxic metal that produces a range of adverse health effects particularly in young children. Lead can cause nervous system

damage and digestive problems, and some lead-containing chemicals cause cancer. Lead can also harm wildlife.

Lead has been phased out of gasoline, which has considerably reduced the contamination of air by lead. However, lead can still be inhaled or ingested from other sources. The sources for lead include paint (for houses and cars), smelters, manufacture of lead batteries, fishing lures, certain parts of bullets, some ceramic ware, water pipes, and a few hair dye products.

Ozone O_3, is a gas that is a variety of oxygen. Oxygen consists of two oxygen atoms; ozone consists of three. Ozone in the upper atmosphere, where it occurs naturally in what is known as the ozone layer, shields the Earth from the sun's dangerous ultraviolet rays. However, at ground level where it is a pollutant with highly toxic effects, ozone damages human health, the environment, crops, and a wide range of natural and artificial materials. Ground-level ozone can irritate the respiratory tract, causing chest pain, persistent cough, an inability to take a deep breath, and an increased susceptibility to lung infection. Ozone can damage trees and plants and reduce visibility.

Ground-level ozone comes from the breakdown (oxidation) of volatile organic compounds found in solvents. It is also a product of reactions between chemicals that are produced by burning coal, gasoline, other fuels, and chemicals found in paints and hair sprays. Oxidation occurs readily during hot weather. Vehicles and industries are major sources of ground-level ozone.

Nitrogen Oxide (NO_x) is a major contributor to smog and acid rain. Nitrogen oxides react with volatile organic compounds to form smog. In high doses, smog can harm humans by causing breathing difficulty for asthmatics, coughs in children, and general illness of the respiratory system. Acid rain can harm vegetation and run into lakes and rivers which changes, the chemistry of the water, and makes it potentially uninhabitable for all but acid-tolerant bacteria.

Nitrogen oxides are produced from burning fuels, including gasoline and coal. (NO_x) acid aerosols can reduce visibility.

Particulate Matter is any type of solid in the air in the form of smoke, dust, and vapors, which can remain suspended for extended periods. Aside from reducing visibility and soiling clothing, microscopic particles in the air can be breathed into lung tissue becoming lodged and causing increased respiratory disease and lung damage. Particulates are also the main source of haze, which reduces visibility.

Particulates are produced by many sources, including burning of diesel fuels by trucks and buses, fossil fuels, mixing and application of fertilizers and pesticides, road construction, industrial processes such as steel making, mining, agricultural burning, and operation of fireplaces and woodstoves.

Sulfur Dioxide (SO_2) is an odorless gas at low concentrations, but can have a very strong smell at high concentrations. SO_2 is a gas produced by burning coal, most notably in power plants. Some industrial processes, such as production of paper and smelting of metals, produce sulfur dioxide.

Like nitrogen oxides, SO_2 is a major contributor to smog and acid rain. SO_2 is closely related to sulfuric acid, a strong acid. It can harm vegetation and metals and can cause lung problems, including breathing problems and permanent damage to lungs.

Volatile Organic Compounds (VOCs) are organic chemicals. All organic compounds contain carbon, and organic chemicals are the basic chemicals found in all living things and in all products derived from living things. Many organic compounds we use do not occur in nature, but were synthesized by chemists in laboratories. Volatile chemicals produce vapors easily. At room temperature vapors readily escape from volatile liquid chemicals.

VOCs include gasoline, industrial chemicals such as benzene, solvents such as toluene and xylene, and perchloroethylene (principal dry cleaning solvent). VOCs are released from burning fuel, such as gasoline, wood, coal, natural gas and from solvents, paints, glues, and other products used at home or work. Vehicle emissions are an important source of VOCs. Many VOCs are hazardous air pollutants; for example, benzene causes cancer (ELSI, Project).

SELF-ASSESSMENT EXERCISE

1. What is indoor air pollution?
2. List some major air pollutants

3.5 Health Effects of Air Pollution

The human health effects of poor air quality are far reaching, but principally affect the body's respiratory system and the cardiovascular system. Individual reactions to air pollutants depend on the type of pollutant a person is exposed to, the degree of exposure, the individual's health status and genetics. People who exercise outdoors, for example, on hot, smoggy days increase their exposure to pollutants in the air.

The health effects caused by air pollutants may range from subtle biochemical and physiological changes to difficulty breathing, wheezing, coughing and aggravation of existing respiratory and cardiac conditions. These effects can result in increased medication use, increased doctor or emergency room visits, more hospital admissions and even premature death (ELSI, Project)

3.5.1 Human Respiratory System

The health of our lungs and entire respiratory system is affected by the quality of the air we breathe. In addition to oxygen, this air contains other substances such as pollutants, which can be harmful. Exposure to chemicals by inhalation can negatively affect our lungs and other organs in the body. The respiratory system is particularly sensitive to air pollutants because much of it is made up of exposed membrane. Lungs are anatomically structured to bring large quantities of air (on average, 400 million litres in a lifetime) into intimate contact with the blood system, to facilitate the delivery of oxygen.

Lung tissue cells can be injured directly by air pollutants such as ozone, metals and free radicals. Ozone can damage the alveoli – the individual air sacs in the lung where oxygen and carbon dioxide are exchanged. More specifically, airway tissues which are rich in bio-activation enzymes can transform organic pollutants into reactive metabolites and cause secondary lung injury. Lung tissue has an abundant blood supply that can carry toxic substances and their metabolites to distant organs. In response to toxic insult, lung cells also release a variety of potent chemical mediators that may critically affect the function of other organs such as those of the cardiovascular system. This response may also cause lung inflammation and impair lung function.

Structure and Function of Human Respiratory System

The human respiratory system is dominated by our lungs, which bring fresh oxygen (O_2) into our bodies while expelling carbon dioxide (CO_2). The oxygen travels from the lungs through the bloodstream to the cells in all parts of the body. The cells use the oxygen as fuel and give off carbon dioxide as a waste gas. The waste gas is carried by the bloodstream back to the lungs to be exhaled.

The lungs accomplish this vital process - called gas exchange - using an automatic and quickly adjusting control system. This gas exchange process occurs in conjunction with the central nervous system (CNS), the circulatory system, and the musculature of the diaphragm and the chest (ELSI Project; Air polluting fact sheet, 2006).

The human respiratory system can be divided into the upper respiratory tract and the lower respiratory tract. The upper respiratory tract includes the following rigid structures:

Nasal cavities: Filter the air we breathe and provide a sense of smell.

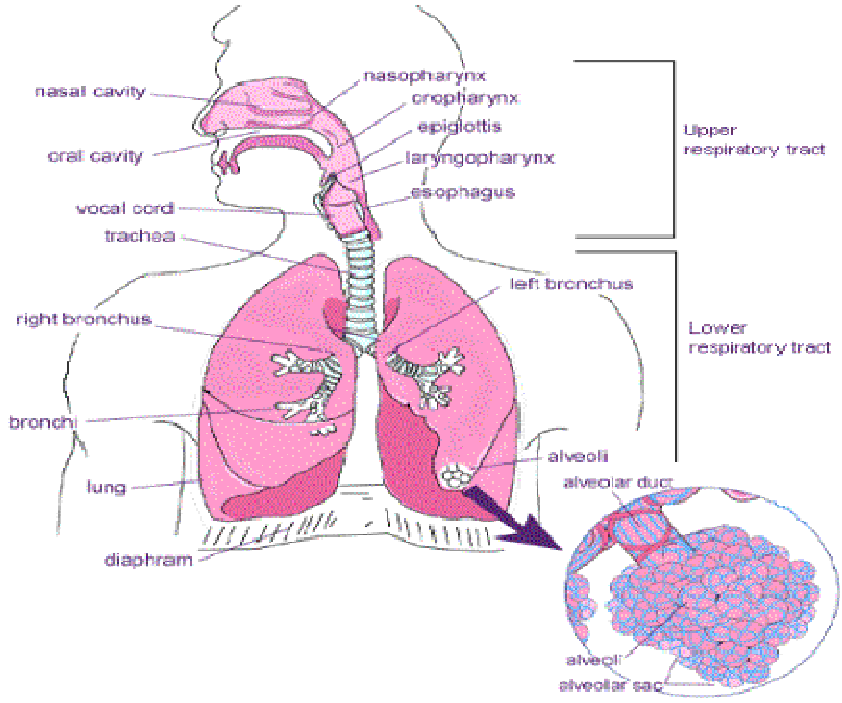
Pharynx: Acts in the respiratory and the digestive system.

Larynx: Link between the pharynx and the trachea, generates the voice with the presence of vocal folds.

Trachea: The trachea is the bond with the lower respiratory tract. This is a flexible structure allowing the air to go down to the lungs.
In addition to gas exchange, the lungs and the other parts of the respiratory system have important jobs to do relating to breathing. These include:

- Bringing all air to the proper body temperature.
- Moisturizing the inhaled air for necessary humidity.
- Protecting the body from harmful substances by coughing, sneezing, filtering or swallowing them, or by alerting the body through the sense of smell.
- Defending the lungs with cilia (tiny hair-like structure), mucus and macrophages, which act to remove harmful substances deposited in the respiratory system

Diagram of Human Respiratory System (Culled from ELSI Project)



The respiratory system is sensitive to air pollution. The cardiovascular system can be affected as well.

3.5.2 Human Cardiovascular System

The cardiovascular system has two major components: the heart and a network of blood vessels. The cardiovascular system supplies the tissues and cells of the body with nutrients, respiratory gases, hormones, and metabolites and removes the waste products of cellular metabolism as well as foreign matter. It is also responsible for maintaining the optimal internal homeostasis of the body and the critical regulation of body temperature and pH.

The inhalation of air pollutants eventually leads to their absorption into the bloodstream and transport to the heart. A wide spectrum of chemical and biological substances may interact directly with the cardiovascular system to cause structural changes, such as degenerative necrosis and inflammatory reactions. Some pollutants may also directly cause functional alterations that affect the rhythmicity and contractility of the heart. If severe enough occurs, functional changes may lead to lethal arrhythmias without major evidence of structural damage to the myocardium.

There also may be indirect actions secondary to changes in other organ systems, especially the central and autonomic nervous systems and selective actions of the endocrine system. Some cytokines released from other inflamed organs may also produce adverse cardiovascular effects, such as reducing the mechanical performance and metabolic efficiency of the heart and blood vessels.

Many chemical substances may cause the formation of reactive oxygen. This oxidative metabolism is considered to be critical to the preservation of cardiovascular function. For example, oxygen free radicals oxidize low-density lipoproteins, and this reaction is thought to be involved in the formation of the atherosclerotic plaques. Oxidized low-density lipoproteins can injure blood vessel cells and increase adherence and the migration of inflammatory cells to the injured area. The production of oxygen free radicals in heart tissues has been associated with arrhythmias, and heart cell death (Air pollution fact sheet, 2006).

3.5.3 Heart and Lung Diseases

Heart and lung illnesses and diseases are common, and there are many factors that can increase the chances of contracting them such as smoking and genetic predisposition. The role of air pollution as the underlying cause remains unclear but is the subject of considerable

research. However, it is clear that air pollution, infections and allergies can exacerbate these conditions. An early diagnosis can lead to appropriate treatment and ensure a normal or close to normal quality of life. In many cases however, there is no cure and those affected may die prematurely. The following are the most prevalent diseases:

Minor Lung Illnesses - the common cold is the most familiar of these, with symptoms including sore throat, stuffy or runny nose, coughing and sometimes irritation of the eyes.

Lung Infections - croup, bronchitis, and pneumonia are caused by viruses or bacteria and are very common. Symptoms may include cough, fever, chills and shortness of breath.

Asthma - is an increasingly common chronic disease among children and adults. It causes shortness of breath, coughing or wheezing or whistling in the chest. Asthma attacks can be triggered by a variety of factors including exercise, infection, pollen, allergies and stress. It can also be triggered by sensitivity to non-allergic types of pollutants present in the air such as smog.

Chronic Obstructive Pulmonary Disease (COPD) - is also known as chronic obstructive lung disease and encompasses two major disorders: emphysema and chronic bronchitis. Emphysema is a chronic disorder in which the walls and elasticity of the alveoli are damaged. Chronic bronchitis is characterized by inflammation of the cells lining the inside of bronchi, which increases the risk of infection and obstructs airflow in and out of the lung. Smoking is responsible for approximately 80% of COPD cases while other forms of air pollution may also influence the development of these diseases. Symptoms include cough, production of mucous and shortness of breath. It is important to note that no cure exists for people suffering from COPD although healthy lifestyle and appropriate medication can help (ELSI Project; Air pollution fact sheet, 2006).

Lung Cancer - is the most common cause of death due to cancer in women and men. Cigarette smoke contains various carcinogens and is responsible for most cases of this often fatal disease. The symptoms of lung cancer begin silently and then progress to chronic cough, wheezing and chest pain. Air pollution has been linked somewhat weakly to lung cancer.

Coronary Artery Disease - refers to the narrowing or blocking of the arteries or blood vessels that supply blood to the heart. This disease includes angina and heart attack which share similar symptoms of pain or pressure in the chest. Unlike angina, the symptoms caused by heart

attack do not subside with rest and may cause permanent damage to the heart. Smoking, lack of exercise, excess weight, high cholesterol levels in the blood, family history and high blood pressure are some of the factors that may contribute to this disease.

Heart Failure - is a condition in which the heart is unable to cope with its work load of pumping blood to the lungs and the rest of the body. The most common cause is severe coronary artery disease. The main symptoms are shortness of breath and swelling of the ankles and feet.

Heart-Rhythm Problems - are irregular or abnormal rhythms of the heart beat. In some cases heart-rhythm problems are caused by coronary artery disease. Symptoms of heart-rhythm problems include fluttering in the chest (palpitation) and feeling light-headed. Some heart-rhythm problems are life-threatening and need emergency treatment (Air pollution fact sheet, 2006).

3.6 Population at Risk

Although everyone is at risk from the health effects of air pollution, certain sub-populations are more susceptible. Individual reactions to air contaminants depend on several factors such as the type of pollutant, the degree of exposure and how much of the pollutant is present. Age and health are also important factors.

The elderly and people suffering from cardio-respiratory problems such as asthma appear to be the most susceptible groups.

Children and newborns are also sensitive to the health effects of air pollution since they take in more air than adults for their body weight and consequently, a higher level of pollutants. People who exercise outdoors on hot and smoggy days are also at greater risk due to their increased exposure to pollutants in the air.

4.0 CONCLUSION

This is a rather long unit. Do bear with us. As you must have observed, there are many aspects to air pollution. So, this unit basically looked at air pollution and the resultant health effects. In defining air pollution, this unit defined it simply as the contamination of air by the discharge of harmful substances.

5.0 SUMMARY

Hope you enjoyed this unit, and didn't find it rather long. This unit generally looked at the health effects of air pollution. It started by defining air pollution as well as indoor and outdoor air pollution. It also identified several air pollutants, health effects and lastly populations at risk. Now let us attempt the following questions below.

6.0 TUTOR-MARKED ASSIGNMENT

What are the health effects of air pollution?

ANSWER TO SELF-ASSESSMENT EXERCISE

1. Indoor air pollution is the presence of excessive levels of air contaminants inside a home or building from sources such as cigarette smoking, fuel combustion for heating or cooking, certain wallboards, carpets, or insulation as well as the geology of the area.

2. i. Carbon Dioxide
   ii. Carbon Monoxide
   iii. Particulate Matter
   iv. Sulfur Dioxide
   v. Ozone
   vi. Lead
   vii. Hazardous air pollutant
   viii. Nitrogen Oxide

7.0 REFERENCES/FURTHER READINGS

ELSI (Ethical, Legal and Social Issues in Science), *Lawrence Berkley National Laboratory Project.* Retrieved from http://www.lbl.gov/Education/ELSI/ELSI.html. Site visited on 26th July 2007.

Air Pollution Fact Sheet March, 2006. National Safety Council, Washington. DC. Retrieved from .http://www.nsc.org/ehc/mobile/airpollu.htm, Site visited on 26th July, 2007.

Samet, J.M., Marbury, Marian C., and Spengler, J.D. (1987). *"HealthEffects and Sources of Indoor Air Pollution, Part I." American Review of Respiratory Disease* 136:1486-1508.

Fiedler, N., Maccia, C., Mpen, H. (1992). *"Evaluation of Chemically Sensitive Patients"*. Journal of Occupational Medicine. 34:529-538.

Heuser, G., Wojdani, A., Heuser, S. (1992). *"Diagnostic Markers of Multiple Chemical Sensitivity". Multiple Chemical Sensitivities: Addendum to Biologic Markers in Immunotoxicology.* National Research Council. National Academy Press. Washington D.C.

UNIT 2 ENVIRONMENT: HEALTH AND WATER POLLUTION

CONTENTS

1.0 INTRODUCTION

This unit provides an in-depth review of water pollution. Thus, comprising over 70 percent of the Earth's surface, water is undoubtedly the most precious natural resource that exists on our planet. Without the seemingly invaluable compound comprised of hydrogen and oxygen, life on Earth would be non-existent, it is essential for everything on our planet to grow and prosper. Although we as humans recognize this fact, we disregard it by polluting our rivers, lakes, and oceans. Subsequently, we are slowly but surely harming our planet to the point where organisms are dying at a very alarming rate. In addition to innocent organisms dying off, our drinking water has become greatly affected as is our ability to use water for recreational purposes. In order to combat water pollution, we must understand the problems and become part of the solution (Krantz and Kiffersrtein, 2006).

2.0 OBJECTIVES

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

- define water pollution;
- identify the major water pollutants;
- identify the causes of water pollution;
- classify water pollution; and
- ascertain the health impact of water pollution.

3.0 MAIN CONTENT

3.1 What is Water Pollution?

According to the American College Dictionary, pollution is defined as: to make foul or unclean; dirty. Water pollution occurs when a body of water is adversely affected due to the addition of large amounts of materials to the water. When it is unfit for its intended use, water is considered polluted.

3.2 What are the Major Water Pollutants?

There are several classes of water pollutants:

- The first are disease-causing agents. **These are bacteria, viruses, protozoa and parasitic worms that enter sewage systems and untreated waste.**

- A second category of water pollutants is oxygen-demanding wastes; wastes that can be decomposed by oxygen-requiring bacteria. When large populations of decomposing bacteria are converting these wastes it can deplete oxygen levels in the water. This causes other organisms in the water, such as fish, to die.

- A third class of water pollutants is water-soluble inorganic pollutants, such as acids, salts and toxic metals. Large quantities of these compounds will make water unfit to drink and will cause the death of aquatic life.

- Another class of water pollutants are nutrients. They are water-soluble nitrates and phosphates that cause excessive growth of algae and other water plants, which deplete the water's oxygen supply. This kills fish and, when found in drinking water, can kill young children.

- Water can also be polluted by a number of organic compounds such as oil, plastics and pesticides, which are harmful to humans and all plants and animals in the water. A very dangerous category is suspended sediment, because it causes depletion in the water's light absorption and the particles spread dangerous compounds such as pesticides through the water.

- Finally, water-soluble radioactive compounds can cause cancer, birth defects and genetic damage and are thus very dangerous water pollutants (Lenntech, 2007)

3.3 Causes of Water Pollution

Many causes of water pollution including sewage and fertilizers containing nutrients such as nitrates and phosphates. In excess levels, nutrients over stimulate the growth of aquatic plants and algae. Excessive growth of these types of organisms consequently clogs our waterways, use up dissolved oxygen as they decompose, and block light to deeper waters. This, in turn, proves very harmful to aquatic organisms as it affects the respiration ability or fish and other invertebrates that reside in water.

Pollution is also caused when silt and other suspended solids, such as soil, wash-off plowed fields, construction and logging sites, urban areas, and eroded river banks when it rains. Under natural conditions, lakes, rivers, and other water bodies undergo *Eutrophication*, an aging process that slowly fills in the water body with sediment and organic matter. When these sediments enter various bodies of water, fish respiration becomes impaired, plant productivity and water depth become reduced, and aquatic organisms and their environments become suffocated.

Pollution in the form of organic material enters waterways in many different forms as sewage, as leaves and grass clippings, or as runoff from livestock feedlots and pastures. When natural bacteria and protozoan in the water break down this organic material, they begin to use up the oxygen dissolved in the water. Many types of fish and bottom-dwelling animals cannot survive when levels of dissolved oxygen drop below two to five parts per million. When this occurs, it kills aquatic organisms in large numbers which leads to disruptions in the food chain.

SELF-ASSESSMENT EXERCISE

Identify the major water pollutants.

Figure 2: An Example of a polluted stream

3.4 Classifying Water Pollution

The major sources of water pollution can be classified as **municipal, industrial, and agricultural.**

Municipal water pollution consists of waste water from homes and commercial establishments. For many years, the main goal of treating municipal wastewater was simply to reduce its content of suspended solids, oxygen-demanding materials, dissolved inorganic compounds, and harmful bacteria. In recent years, however, more stress has been placed on improving means of disposal of the solid residues from the municipal treatment processes. The basic methods of treating municipal wastewater fall into three stages: *primary treatment*, including grit removal, screening, grinding, and sedimentation; *secondary treatment*, which entails oxidation of dissolved organic matter by means of using biologically active sludge, which is then filtered off; *and tertiary treatment*, in which advanced biological methods of nitrogen removal and chemical and physical methods such as granular filtration and activated carbon absorption are employed. The handling and disposal of solid residues can account for 25 to 50 percent of the capital and operational costs of a treatment plant.

The characteristics of industrial waste waters can differ considerably both within and among industries. The impact of industrial discharges depends not only on their collective characteristics, such as biochemical oxygen demand and the amount of suspended solids, but also on their content of specific inorganic and organic substances. Three options are available in controlling industrial wastewater. Control can take place at the point of generation in the plant; wastewater can be pretreated for

discharge to municipal treatment sources; or wastewater can be treated completely at the plant and either reused or discharged directly into receiving waters.

Agriculture, including commercial livestock and poultry farming, is the source of many organic and inorganic pollutants in surface waters and groundwater. These contaminants include both sediment from erosion cropland and compounds of phosphorus and nitrogen that partly originate in animal wastes and commercial fertilizers. Animal wastes are high in oxygen demanding material, nitrogen and phosphorus, and they often harbor pathogenic organisms. Wastes from commercial feeders are contained and disposed of on land; their main threat to natural waters, therefore, is from runoff and leaching. Control may involve settling basins for liquids, limited biological treatment in aerobic or anaerobic lagoons, and a variety of other methods.

3.5 Health Impacts of Water Pollution

It is a well-known fact that clean water is absolutely essential for healthy living. Adequate supply of fresh and clean drinking water is a basic need for all human beings on the earth, yet it has been observed that millions of people worldwide are deprived of this. (Edugreen, 2006)

Freshwater resources all over the world are threatened not only by over exploitation and poor management but also by ecological degradation. The main source of freshwater pollution can be attributed to discharge of untreated waste, dumping of industrial effluent, and run-off from agricultural fields. Industrial growth, urbanization and the increasing use of synthetic organic substances have serious and adverse impacts on freshwater bodies. It is a generally accepted fact that the developed countries suffer from problems of chemical discharge into the water sources mainly *groundwater*, while developing countries face problems of agricultural run-off in water sources. Polluted water *like chemicals in drinking water* causes problem to health and leads to *water-borne diseases* which can be prevented by taking measures even at the household level (Edugreen, 2006)

3.5.1 Groundwater and its Contamination

Many areas of groundwater and surface water are now contaminated with heavy metals, POPs (persistent organic pollutants), and nutrients that have an adverse affect on health. Water-borne diseases and water-caused health problems are mostly due to inadequate and incompetent management of water resources. Safe water for all can only be assured when access, sustainability, and equity can be guaranteed. Access can be defined as the number of people who are guaranteed safe drinking water

and sufficient quantities of it. There has to be an effort to sustain it, and there has to be a fair and equal distribution of water to all segments of the society. Urban areas generally have a higher coverage of safe water than the rural areas. Even within an area there is variation: areas that can pay for the services have access to safe water whereas areas that cannot pay for the services have to make do with water from hand pumps and other sources.

In the urban areas water gets contaminated in many different ways, some of the most common reasons being leaky water pipe joints in areas where the water pipe and sewage line pass close together. Sometimes the water gets polluted at source due to various reasons and mainly due to inflow of sewage into the source.

Ground water can be contaminated through various sources and some of these are mentioned below:

Pesticides: Run-off from farms, backyards, and golf courses contain pesticides such as DDT that in turn contaminate the water. Leechate from landfill sites is another major contaminating source. Its effects on the ecosystems and health are endocrine and reproductive damage in wildlife. Groundwater is susceptible to contamination, as pesticides are mobile in the soil. It is a matter of concern as these chemicals are persistent in the soil and water.

Sewage: Untreated or inadequately treated municipal sewage is a major source of groundwater and surface water pollution in the developing countries. The organic material that is discharged with municipal waste into the watercourses uses substantial oxygen for biological degradation thereby upsetting the ecological balance of rivers and lakes. Sewage also carries microbial pathogens that are the cause of the spread of disease.

Nutrients: Domestic waste water, agricultural run-off, and industrial effluents contain phosphorus and nitrogen, fertilizer run-off, manure from livestock operations, which increase the level of nutrients in water bodies and can cause eutrophication in the lakes and rivers and continue on to the coastal areas. The nitrates come mainly from the fertilizer that is added to the fields. Excessive use of fertilizers causes nitrate contamination of groundwater, with the result that nitrate levels in drinking water is far above the safety levels recommended. Good agricultural practices can help in reducing the amount of nitrates in the soil and thereby lower its content in the water.

Synthetic organics: Many of the 100 000 synthetic compounds in use today are found in the aquatic environment and accumulate in the food chain. POPs or Persistent organic pollutants, represent the most harmful

element for the ecosystem and for human health, for example, industrial chemicals and agricultural pesticides. These chemicals can accumulate in fish and cause serious damage to human health. Where pesticides are used on a large-scale, groundwater gets contaminated and this leads to the chemical contamination of drinking water.

Acidification: Acidification of surface water, mainly lakes and reservoirs, is one of the major environmental impacts of transport over long distance of air pollutants such as sulphur dioxide from power plants, other heavy industry such as steel plants, and motor vehicles. This problem is more severe in the developed world.

3.5.2 Chemicals in Drinking Water

Chemicals in water can be both naturally occurring or introduced by human interference and can have serious health effects.

Fluoride: Fluoride in the water is essential for protection against dental caries and weakening of the bones, but higher levels can have an adverse effect on health. High fluoride content could be found naturally in some waters.

Arsenic: Arsenic occurs naturally or is possibly aggravated by over powering aquifers and by phosphorus from fertilizers. High concentrations of arsenic in water can have an adverse effect on health. A few years back, high concentrations of this element was found in drinking water in six districts in West Bengal, in India. A majority of people in the area was found suffering from arsenic skin lesions. It was felt that arsenic contamination in the groundwater was due to natural causes.

Lead: Pipes, fittings, solder, and the service connections of some household plumbing systems contain lead that contaminates the drinking water source.

Recreational use of water: Untreated sewage, industrial effluents, and agricultural waste are often discharged into the water bodies such as the lakes, coastal areas and rivers endangering their use for recreational purposes such as swimming and canoeing.

Petrochemicals: Petrochemicals contaminate the groundwater from underground petroleum storage tanks.

Other heavy metals: These contaminants come from mining waste and tailings, landfills, or hazardous waste dumps.

Chlorinated solvents: Metal and plastic effluents, fabric cleaning, electronic and aircraft manufacturing are often discharged and contaminate groundwater.

3.5.3 Disease

Cause	Water-borne diseases
Bacterial infections	Typhoid Cholera Paratyphoid fever Bacillary dysentery
Viral infections	Infectious Hepatitis (jaundice) Poliomyelitis
Protozoal infections	Amoebic dysentery

Water-borne diseases are infectious diseases spread primarily through contaminated water. Though these diseases are spread either directly or through flies or filth, water is the chief medium for spread of these diseases and hence they are termed as water-borne diseases.

Most intestinal (enteric) diseases are infectious and are transmitted through faecal waste. Pathogens – which include virus, bacteria, protozoa, and parasitic worms – are disease-producing agents found in the faeces of infected persons. These diseases are more prevalent in areas with poor sanitary conditions. These pathogens travel through water sources and interfuses directly through persons handling food and water. Since these diseases are highly infectious, extreme care and hygiene should be maintained by people looking after an infected patient. Hepatitis, cholera, dysentery, and typhoid are the more common water-borne diseases that affect large populations in the tropical regions. A large number of chemicals that either exist naturally in the land, or are added due to human activity dissolve in the water, thereby contaminating it and leading to various diseases.

Pesticides: The organophosphates and the carbonates present in pesticides affect and damage the nervous system and can cause cancer. Some of the pesticides contain carcinogens that exceed recommended levels. They contain chlorides that cause reproductive and endocrinal damage.

Lead: Lead is hazardous to health as it accumulates in the body and affects the central nervous system. Children and pregnant women are most at risk.

Fluoride: Excess fluorides can cause yellowing of the teeth and damage to the spinal cord and other crippling diseases.

Nitrates: Drinking water that gets contaminated with nitrates can prove fatal especially to infants that drink formula milk as it restricts the amount of oxygen that reaches the brain causing the 'blue baby' syndrome. It is also linked to digestive tract cancers. It causes algae to bloom resulting in eutrophication in surface water.

Petrochemicals: Benzene and other petrochemicals can cause cancer even at low exposure levels.

Chlorinated solvents: These are linked to reproduction disorders and to some cancers.

Arsenic: Arsenic poisoning through water can cause liver and nervous system damage, vascular diseases and also skin cancer.
Other heavy metals: –Heavy metals cause damage to the nervous system and the kidney, and other metabolic disruptions.

Salts: It makes the fresh water un-safe for drinking and irrigation purposes.

Exposure to polluted water can cause diarrhea, skin irritation, respiratory problems, and other diseases, depending on the pollutant that is in the water body. Stagnant water and other untreated water provide a habitat for the mosquito and a host of other parasites and insects that cause a large number of diseases especially in the tropical regions. Among these, malaria is undoubtedly the most widely distributed and causes most damage to human health (ELSI Project)

4.0 CONCLUSION

This unit provided a general perspective of causes and effects of water pollution. Specifically, it states that water pollution occurs when a body of water is adversely affected due to the addition of large amounts of materials to the water. When it is unfit for its intended use, water is considered polluted. Sewage and fertilizers containing nutrients such as nitrates and phosphates, oil, excess growth of aquatic plants and algae, etc. were identified as various causes of water pollution. Water pollution was further classified into municipal, agricultural and industrial pollutions. Lastly, health effects of water pollution, was illustrated in the line of groundwater and its contaminations, chemicals in drinking water and diseases.

5.0 SUMMARY

In this unit, we looked the definition and causes of water pollution as well as major water pollutants. This unit further classified water pollution in terms of municipal, industrial and agricultural and further identified the health effects of water pollution. I hope you enjoyed your studies. Now let us attempt the questions below.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define water pollution
2. identify the causes of water pollution
3. Identify the health impacts of water pollution

ANSWER TO SELF-ASSESSMENT EXERCISE

Major water pollutants are:

i. Disease-causing agents - these are bacteria, viruses, protozoa and parasitic worms that enter sewage systems and untreated waste.
ii. A second category of water pollutants is oxygen-demanding wastes; wastes that can be decomposed by oxygen-requiring bacteria. When large populations of decomposing bacteria are converting these wastes it can deplete oxygen levels in the water.
iii. Another class of water pollutants are nutrients. They are water-soluble nitrates and phosphates that cause excessive growth of algae and other water plants, which deplete the water's oxygen supply. This kills fish and, when found in drinking water, can kill young children.
iv. Water can also be polluted by a number of organic compounds such as oil, plastics and pesticides, which are harmful to humans and all plants and animals in the water.
v. Finally, water-soluble radioactive compounds can cause cancer, birth defects and genetic damage and are thus very dangerous water pollutants.

7.0 REFERENCES/FURTHER READINGS

Edugreen (2006). *Making Environmental Learning Fun for the Young. UNEP-Teri . http://edugreen.teri.res.in/index.asp*

ELSI (Ethical, Legal and Social Issues in Science), *Lawrence Berkley National laboratory Project.* Retrieved from http://www.lbl.gov/Education/ELSI/ELSI.html. Site visited on 26th July 2007.

Lenntech, (2007). *Water Pollution FAQ Rotterdamseweg 402 M2629 HH Delft, The Netherlands* http://www.lenntech.com/water-pollution-FAQ.htm

Terry, L. A. (1996). *Water Pollution Environ Law Pract., vol. 4, no. 1, pp. 19-29,* Poppe, W. and Hurst, R. (1997). *Water Pollution Water qualint, pp. 39-43.*

Richman, M. (1997). *Water Pollution Waste Water, Vol. 5, no. 2, pp. 24-29.*

Tibbetts, J. A. (1996). *Water Environ. Solutions, vol. 9, no. 8, p. 26.*

Onsdorff, K. A. (1996). *Pollution, Water Environ. Law Pract., vol. 4, no. 1, pp. 14-18.*

MacDonnell, L. J. (1996). *Water Quality*. *Land Water Law Review., vol. 31, no. 2, pp. 329-348.*

Brassard, P. G. (1996). *Wetlands and Water Pollution.* Boston Coll. Environ. Aff. Law Review, vol. 23, no. 4, pp. 885-919.

Ungate, C. D. (1996). *Clean Water Initiative*. Journal of Environmental Planning Management., vol. 39, no. 1, pp. 113-122.

Lindsey, T., Neese, S. and Thomas, D. (1996). *Pollution Prevention. Water Quality Int.*, pp. 32-36, 1996

Gannon, R. W., Osmond, D. L., Humenik, F. J., Gale, J. A. and Spooner, J. (1996). Agricultural Water Quality. *Water Resources Bulletin, vol. 32, no. 3, pp. 437-450.*

UNIT 3 ENVIRONMENT, HEALTH AND RADIATION

CONTENTS

1.0 INTRODUCTION

We cannot eliminate radiation from our environment, especially now that the global has introduced mobile phones and related services, and the erection of masts, sometimes erected haphazardly to aid telecommunication receptions. We can, however, reduce our risks by controlling our exposure to it. Understanding radiation and radioactivity will help you make informed decisions about your exposure.

2.0 OBJECTIVES

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

- describe radiation;
- describe radioactivity;
- describe atoms and what causes it to be radioactive;
- ascertain how people are exposed to radioactivity;
- ascertain the health effects of radiation;
- determine the cancer causing effects of radiation; and
- ascertain if children are more sensitive to radiation than adults.

3.0 MAIN CONTENT

3.1 What is Radiation?

Radiation is energy that travels in the form of waves or high speed particles.

When we hear the word ' radiation', we generally think of nuclear power plants, nuclear weapons, or radiation treatments for cancer. We would also be correct to add 'microwaves, radar, electrical power lines, cellular phones, and sunshine' to the list. There are many different types of radiation that have a range of energy forming an electromagnetic spectrum. However, when you see the word 'radiation' in this unit, we are referring to the types of radiation used in nuclear power, nuclear weapons, and medicine. These types of radiation have enough energy to break chemical bonds in molecules or remove tightly bound electrons from atoms, thus creating charged molecules or atoms (ions). These types of radiation are referred to as 'ionizing radiation.'

3.2 What is Radioactivity?

Radioactivity is the property of some atoms that causes them to spontaneously give off energy as particles or rays. Radioactive atoms emit ionizing radiation when they decay.

3.3 What is an Atom?

To be able to understand radiation and radioactivity, you need to understand the language of atomic structure:

Atoms are the extremely small particles of which we, and everything around us, are made. There are 92 naturally occurring elements and scientists have made another 17, bringing the total to 109. Atoms are the

smallest unit of an element that chemically behaves the same way the element does.

When two chemicals react with each other, the reaction takes place between individual atoms--at the atomic level. The processes that cause materials to be radioactive--to emit particles and energy--also occur at the atomic level (ELSI Project).

3.3.1 Why Some Atoms are radioactive?

The balance of the forces in the nucleus of an atom determines whether a nucleus is stable or unstable, and is the key to answering these questions:

3.3.1.1 What Causes Atoms to be Radioactive?

Atoms found in nature are either stable or unstable. An atom is stable if the forces among the particles that make up the nucleus are balanced. An atom is unstable (radioactive) if these forces are unbalanced--if the nucleus has an excess of internal energy. Unstable atoms are called *radionuclides*. The instability of a radionuclide's nucleus may result from an excess of either neutrons or protons. An unstable nucleus will continually vibrate and contort and, sooner or later, attempt to reach stability by some combination of means:

- ejecting neutrons, and protons
- converting one to the other with the ejection of a beta particle or positron
- the release of additional energy by photon (i.e., gamma ray) emission.

SELF-ASSESSMENT EXERCISE

i. What is radiation?
ii. What is radioactivity?
iii. To be able to understand radiation and radioactivity, you need to understand the language of ----------

3.4 How are People Exposed to Radiation?

When we hear the words ' radiation exposure,' we generally think of radiation from a source beaming out and striking the exterior of a body. However, radioactive particles can also become lodged inside the body and expose internal organs as the radionuclides decay. As a result, health physicists consider not only the type of radiation emitted from a source but also the routes by which people are likely to come in contact with it.

There are three main routes of exposure or exposure pathways

- inhalation
- ingestion
- direct exposure

3.4.1 Inhalation

Exposure by the inhalation pathway occurs when people breathe radioactive materials into the lungs. The chief concerns are radioactively contaminated dust, smoke, or gaseous radionuclides such as radon.

3.4.1.1 What Happens to Inhaled Radioactive Materials?

Radioactive particles can lodge in the lungs and remain for a long time. As long as it remains and continues to decay, the exposure continues. For radionuclides that decay slowly, the exposure continues over a very long time. Inhalation is of most concern for radionuclides that are alpha or beta particle emitters. Alpha and beta particles can transfer large amounts of energy to surrounding tissue, damaging DNA or other cellular material. This damage can eventually lead to cancer or other diseases and mutations.

3.4.2 Ingestion

Exposure by the ingestion pathway occurs when someone swallows radioactive materials. Alpha and beta emitting radionuclides are of most concern for ingested radioactive materials. They release large amounts of energy directly to tissue, causing DNA and other cell damage.

3.4.2.1 What Happens to Ingested Radioactive Materials?

Ingested radionuclides can expose the entire digestive system. Some radionuclides can also be absorbed and expose the kidneys and other organs, as well as the bones. Radionuclides that are eliminated by the body fairly quickly are of limited concern. These radionuclides have a short biological half-life.

3.4.3 Direct (External) Exposure

The third pathway of concern is direct or external exposure from radioactive material.

The concern about exposure to different kinds of radiation varies:

- Limited concern about alpha particles. They cannot penetrate the outer layer of skin, but if you have any open wounds you may be at risk.
- Greater concern about beta particles. They can burn the skin in some cases, or damage eyes.
- Greatest concern is about gamma radiation. Different radionuclides emit gamma rays of different strength, but gamma rays can travel long distances and penetrate entirely through the body.

Gamma rays can be slowed by dense material (shielding), such as lead, and can be stopped if the material is thick enough. Examples of shielding are containers; protective clothing, such as a lead apron; and soil covering buried radioactive materials (ELSI Project).

3.5 How does Radiation Cause Health Effects?

Radioactive materials that decay spontaneously produce ionizing radiation, which has sufficient energy to strip away electrons from atoms (creating two charged ions) or to break some chemical bonds. Any living tissue in the human body can be damaged by ionizing radiation in a unique manner. The body attempts to repair the damage, but sometimes the damage is of a nature that cannot be repaired or it is too severe or widespread to be repaired. Also mistakes made in the natural repair process can lead to cancerous cells. The most common forms of ionizing radiation are alpha and beta particles, or gamma and X-rays.

3.5.1 What Kinds of Health effects does Exposure to Radiation Cause?

In general, the amount and duration of radiation exposure affects the severity or type of health effect. There are two broad categories of health effects: stochastic and non-stochastic.

Stochastic Health Effects

Stochastic effects are associated with long-term, low-level (chronic) exposure to radiation. ("Stochastic" refers to the likelihood that something will happen.) Increased levels of exposure make these health effects more likely to occur, but do not influence the type or severity of the effect.

Cancer is considered by most people the primary health effect from radiation exposure. Simply put, cancer is the uncontrolled growth of

cells. Ordinarily, natural processes control the rate at which cells grow and replace themselves. They also control the body's processes for repairing or replacing damaged tissue. Damage occurring at the cellular or molecular level, can disrupt the control processes, permitting the uncontrolled growth of cells--cancer. This is why ionizing radiation's ability to break chemical bonds in atoms and molecules makes it such a potent carcinogen.

Other stochastic effects also occur. Radiation can cause changes in DNA, the "blueprints" that ensure cell repair and replacement produces a perfect copy of the original cell. Changes in DNA are called mutations.

Sometimes the body fails to repair these mutations or even creates mutations during repair. The mutations can be teratogenic or genetic. Teratogenic mutations are caused by exposure of the fetus in the uterus and affect only the individual who was exposed. Genetic mutations are passed on to offspring.

Non-Stochastic Health Effects

Non-stochastic effects appear in cases of exposure to high levels of radiation, and become more severe as the exposure increases. Short-term, high-level exposure is referred to as 'acute' exposure.

Many non-cancerous health effects of radiation are non-stochastic. Unlike cancer, health effects from 'acute' exposure to radiation usually appear quickly. Acute health effects include burns and radiation sickness. Radiation sickness is also called 'radiation poisoning.' It can cause premature aging or even death. If the dose is fatal, death usually occurs within two months. The symptoms of radiation sickness include: nausea, weakness, hair loss, skin burns or diminished organ function.
Medical patients receiving radiation treatments often experience acute effects, because they are receiving relatively high "bursts" of radiation during treatment.

3.6 Is any Amount of Radiation Safe?

There is no firm basis for setting a "safe" level of exposure above background for stochastic effects. Many sources emit radiation that is well below natural background levels. This makes it extremely difficult to isolate its stochastic effects. Some scientists assert that low levels of radiation are beneficial to health (this idea is known as hormesis). However, there do appear to be threshold exposures for the various non-stochastic effects (ELSI Project).

3.7 How do we know Radiation Causes Cancer?

Basically, we have learned through observation. When people first began working with radioactive materials, scientists didn't understand radioactive decay, and reports of illness were scattered.

As the use of radioactive materials and reports of illness became more frequent, scientists began to notice patterns in the illnesses. People working with radioactive materials and x-rays developed particular types of uncommon medical conditions. For example, scientists recognized as early at 1910 that radiation caused skin cancer. Scientists began to keep track of the health effects, and soon set up careful scientific studies of groups of people who had been exposed.

Among the best known long-term studies are those of Japanese atomic bomb blast survivors, other populations exposed to nuclear testing fallout (for example, natives of the Marshall Islands), and uranium miners.

3.8 Are Children more Sensitive to Radiation than Adults?

Yes, because children are growing more rapidly, there are more cells dividing and a greater opportunity for radiation to disrupt the process. Fetuses are also highly sensitive to radiation. The resulting effects depend on which systems are developing at the time of exposure.

4.0 CONCLUSION

In this unit, we defined radiation as the energy that travels in the form of waves or high speed particles. Radioactivity is the property of some atoms that causes them to spontaneously give off energy as particles or rays. Radioactive atoms emit ionizing radiation when they decay. To be able to understand radiation and radioactivity, you need to understand the language of atomic structure. It was also observed that an unstable atom will continually vibrate and contort and, sooner or later, attempt to reach stability by some combination of means: ejecting neutrons, and protons, converting one to the other with the ejection of a beta particle or positron and the release of additional energy by photon (i.e., gamma ray) emission. We also saw that people are generally exposed to radiation through inhalation, ingestion and direct external exposure. Also, the health effects of radiation ranged from stochastic to non-stochastic effects.

5.0 SUMMARY

Hope you found this unit insightful. This unit handled the concept of radiation, radioactivity, atoms and general health effects of radiation. Now let us attempt the questions below.

ANSWER TO SELF-ASSESSMENT EXERCISE

- Radiation is energy that travels in the form of waves or high speed particles.
- Radioactivity is the property of some atoms that causes them to spontaneously give off energy as particles or rays. Radioactive atoms emit ionizing radiation when they decay.
- To be able to understand radiation and radioactivity, you need to understand the language of atomic structure

6.0 TUTOR-MARKED ASSIGNMENT

How are people exposed to radiation?

7.0 REFERENCES/FURTHER READINGS

Edugreen (2006). *Making Environmental Learning Fun for the Young.* UNEP-Teri . http://edugreen.teri.res.in/index.asp

ELSI (Ethical, Legal and Social Issues in Science), *Lawrence Berkley NationalLaboratory Project.* Retrieved from http://www.lbl.gov/Education/ELSI/ELSI.html. Site visited on 26th July 2007.

MODULE 4 ENVIRONMENTAL HEALTH EDUCATION, WASTE DISPOSAL, POLLUTION PREVENTION, ENVIRONMENTAL MANAGEMENT IN NIGERIA: PROBLEMS AND PROSPECTS

UNIT 1 ENVIRONMENTAL HEALTH EDUCATION

CONTENTS

1.0 INTRODUCTION

This unit presents an overview of methods of health education and its application to environmental health. This is of the assumption that health cannot be attained in isolation of the environment and also that health does not come automatically, it is learned and the learning must be acted upon.

2.0 OBJECTIVES

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

- define health education;
- identify methods of environmental health education;
- identify types of environmental messages;
- apply environmental health education to individuals and communities; and
- evaluate environmental health education.

3.0 MAIN CONTENT

3.1 Definition of Health Education

Health education is a process with intellectual, psychological, and social dimensions relating to activities which increase the abilities of people to make informed decisions affecting their personal, family and community well-being. This process based on scientific principles, facilitates learning and behavioural change in both health personnel and consumers (Ross and Mico, 1980).

3.2 Methods of Environmental Health Education

There are many methods of environmental health education, but underlying every method is '*communication*'. Communication is thus an essential ingredient of social change. Among methods of communication employed in health education includes:

- Traditional Methods: include proverbs, songs, dance and town criers.
- Method of Involvement
- Demonstration
- Use of symbols, posters, display of films
- Lectures and personal instructions
- The mass media

SELF-ASSESSMENT EXERCISE

Identify the role of the mass media on environmental health education.

3.3 Types of Environmental Messages

There are two categories of messages to develop for environmental health education. These are:

- Educational Messages
- Motivational Messages (Kavanagh, 1988).

It should therefore be noted that the fact that a message is educational does not preclude its being motivational, and vice versa. Certain messages can be created to be mostly educational, appealing primarily to a group of individual's knowledge base. Other messages may be created to appeal to the attitudes or practices of groups or individual.

3.3.1 Types of Educational Messages

A Environment includes:

- Your house and your surroundings
- The air around you
- The spring, streams, rivers
- The land, your garden or farm

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- Protect your house from windstorm by planting windbreakers
- Protect the air you breath, by not burning things unnecessarily
- Protect your farm by not over-cropping or overgrazing
- Protect your sources of water by not polluting it.

3.3.2 Motivational Messages

- Be concerned about your environment: It is a determinant of your health status
- You will have a sound sleep on a windy night if you plant windbreakers around your house.
- The refuse you dump into the gutter will be washed out onto the street by rain storm, making the street look unsightly. Do not dump refuse into the gutter.
- Prevent erosion by leaving your surroundings as much as possible in its natural state (Olaniran, et al, 1995)

3.4 Application of Environmental Health Education to Individual and Community

The aim of environmental health education is to educate individuals and communities on the need for a better environment for a healthier life. All natural resources come from the environment, and these resources are not inexhaustible. The environment must therefore be protected so that it can continue to sustain the resources.

Individual role in protecting the environment begins with his or her surroundings. We are familiar with the desolate appearances of some houses in the cities and villages. Instead of leaving our surroundings bare and open to erosion, we should plant trees to prevent erosion and also purify the air around us.

The state and the national environmental sanitation exercises are exercises in environmental protection that are applied at the level of the individual. Although, environmental courts are set up at every local government headquarters to enforce this exercise by trying offenders, the aim of the exercise is to inculcate in the people a desire and willingness to keep their environment clean, not by coercion but by self motivation, through education.

3.5 Evaluation of Environmental Health Education

Health education is not complete without evaluation. Evaluation is thus, the judgment of value, based on measuring or assessing the results of a programme or activity. Also, outcome of evaluation depends on goals, objectives and methods. The five environmental health education goals therefore include:

- Changes in environmental health consciousness
- Changes in environmental health knowledge
- Changes in self awareness, attitudes and decision making skills
- Behaviour change
- Social change

4.0 CONCLUSION

This unit thus defined health education is a process with intellectually, psychological, and social dimensions relating to activities which increase the abilities of people to make informed decisions affecting their personal, family and community well-being. It further illustrated forms of environmental health education to include the use of traditional methods, demonstration, mass media, etc. Application of environmental

health education to individual and community was further discussed and lastly, evaluation of environmental health education was illustrated.

5.0 SUMMARY

Hope you enjoyed this unit. This unit gave a broad view of environmental health education. Ok! Let us attempt the following questions below.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define health education
2. List methods of environmental health education
3. Identify types of environmental messages

7.0 REFERENCES/FURTHER READINGS

Anijah-Obi, F. (2000). *Environmental Management in Nigeria: Problems and Prospects.* In H. I. Ajaegbu, B. J. Matthew-Daniel and O. E. Uya (Eds). *Nigeria: A People United, a Future Assured,* Vol 1(A Compendium). Federal Ministry of Information: Gubabo Pub. Co.

Anijah-Obi (1996). Environmental Crisis: An Overview. In P. Alozie (ed), *Technology, Science and Environment: A Current Overview of Nigeria*. Aba: Vitalis Press.

Kavanagh, K. (1988). *Social Mobilization for Immunization Manual for Community Education.* The ICEM project CUSO: Calabar.

Nigerian Environmental Study/Action Team (NEST), (1991). *Nigeria's Threatened Environment: A National Profile,* NEST: Ibadan.

Olaniran, N. S., Akpan, E. A., Ikpeme, E. E. and Udofia, G. A. (1995). *Environment and Health. (Module eleven)* Lagos: Macmillan Nigeria Pub.

Ross, H. S. and Mico, P. R. (1980). *Theory and Practice in Health Education*. Palo Acto, CA; Mayfielf Pub. Co.

Uchegbu, S. N. (2002). *Environmental Management and Protection* (second edition). Enugu: Spotlite Publishers.

UNIT 2 WASTE MANAGEMENT AND SUSTAINABLE DEVELOPMENT

CONTENTS

1.0 INTRODUCTION

This unit basically introduces waste management and sustainable development. Due to rapid urbanization, waste management has become a major global problem. Man's unguided development and ineffective solid waste management has become a problem especially in the urban cities. As it stand, effective waste management in our urban centers needs to be addressed to achieve sustainable development (Uchegbu, 2002).

2.0 OBJECTIVES

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

- define waste, solid waste and sewage; and
- illustrate the idea behind turning waste to wealth.

3.0 MAIN CONTENT

3.1 What is Waste?

A good number of authors have defined waste as 'any unavoidable material resulting from domestic activity or industrial operation for which there is no economic demand and which must be disposed of' (Tchobanoglous, et, al., 1977; Sridhar, 1996). Odocha (1994), also defined waste as materials which though may no longer be needed here, may become feedstock or raw material elsewhere. The author also defined waste as 'those materials, which are generated as a result of normal operations over which we have controls in terms of their

production, disposal or discharge'. Wastes do not, therefore, altogether apply to worthless substances.

Wastes are generally categorized into solid and liquid waste, which are materials discharged in household dustbins, flush-down toilets and chemical processing. Household wastes include: bottles, vegetable trimmings, cans, plastics, etc.

3.2 Management of Solid Waste

Solid waste products arise from our way of life. The methods adopted for effective handling of solid waste include the following:

Incineration – controlled process by which solid, liquid or gaseous wastes are burnt and changed into gases and the residue produced contains little or no combustible materials (Tchobanoglous, et, al., 1977).

Composting – A method of solid waste handling by which highly degradable organic matter, animal, crop, and food remains are collected in layers in pits to be acted upon by bacteria to produce compost which is used as soil conditioner.

Land Filling – involves using the biodegradable solid waste to cover the depressed areas of the earth surface which can still put the land into other uses, be it agricultural, residential or commercial.

Shredding – is the method of reducing the hips of refuse dump in order to accommodate large volumes of such waste at the same site.

Resource Recovery – involves sorting out some useful material from waste dump, which can be recycled for other uses.

Animal Feeding – involves the feeding of the animals with refuse remains. These materials must be an essential component in animal ration.

Bioremediation – involves the use of microorganisms, which feed on hydrocarbons to reduce toxic chemicals from the environment.

The application of any of the above methods or a combination of the methods depends on the socio-economic background and the immediate needs of the waste management organization (Uchegbu, 2002). All these, of course reduce health effects and toxicity of the environment and thus encourages sustainable development.

SELF-ASSESSMENT EXERCISE

Identify some waste management methods.

3.3 Sewage Management

Sewage (wastewater) is the water carried wastes or the used water of any community and consists of:

- Domestic sewage
- Industrial Sewage
- Storm water sewage

In order to ascertain the appropriate disposal method, some characteristics of the sewage ought to be known. These include:

- The quantity
- Biological Oxygen Demand (BOD)
- Dissolved oxygen
- Suspended solids
- Dissolved solid
- Synthetic detergents
- Ammonia content
- Copper,
- Phenol
- Zinc content

Two conventional methods for the treatment of sewage are:

- Primary treatments – which consist of the screening stage (with bar screens) or the use of comminutor, the chamber and the sedimentation tank, sludge treatment and stabilization stage, and the chlorination stage.

- Secondary treatment – which involves biological processes that oxidizes, dissolves and finally suspends materials. The basic methods of providing this biological treatment are: tickling, filters and the use of sludge or aeration (Boon, 1975). Secondary treatments are needed when the receiving waters are small or slow or waters come from a large population (DeGhiarra and Koppelman, 1971).

3.4 Waste as Wealth

It must be called to mind from initial definition of waste that waste, do not mean useless or altogether worthless substances, as one waste here may become raw material elsewhere. Piles of refuse in dup sites especially in urban cities are filled with plastic and other recyclables. Little wonder then why they have been christened 'scavengers paradise' (Osuji, 1994). Scavengers could be readily seen foraging the heaps and clamoring at every fresh truckload. Steps in positive directions need to be taken to reconvert these wastes to wealth. To be able to achieve success in this area, wastes should be separated into their various components right from the generation stage. For more efficiency in the conversion of wastes to wealth, privatization of public waste management should be also encouraged (Falomo, 1995).

4.0 CONCLUSION

This unit looked at the issue of waste management for sustainable development and the need to turn waste to wealth was further buttressed. We also identified several waste management methods which could, of course provide a better and healthier environment and thus sustainable development.

5.0 SUMMARY

Hope you enjoyed your studies. This unit highlighted several waste management concepts and methods. Now let us attempt the following questions.

ANSWER TO SELF-ASSESSMENT EXERCISE

i. Incineration
ii. Composting
iii. Land Filling
iv. Shredding
v. Resource recovery
vi. Animal feeding
vii. Bioremediation

6.0 TUTOR-MARKED ASSIGNMENT

1. Define waste
2. In order to ascertain the appropriate disposal method, some characteristics of the sewage ought to be known. They are ……

7.0 REFERENCES/FURTHER READINGS

Anijah-Obi, F. (2000). *Environmental Management in Nigeria: Problems and Prospects*. In H. I. Ajaegbu, B. J. Matthew-Daniel and O. E. Uya (Eds). *Nigeria: A People United, a Future Assured* Vol 1(A Compendium). Federal Ministry of Information: Gubabo Pub. Co.

Boon, A. G. (1975). *Technical Review of the use of Oxygen in the Treatment of Waste Water confi. Inst Water Pollution Control,* Bourner Month Sept.

DeChiara, J. and Koppleman, L. (1971). *Urban Planning and Design Criteria.* New York: McGraw-Hill Book Company.

Falomo, A. A. (1995). *'City Waste as a Public Nuisance'* Paper Presented at the Annual Conference of the Nigerian Environmental Society, Lagos.

Odocha, J. N. K. (1994). *Waste Generation and Management in a Depressed Economy.* Enugu: A lecture delivered at UNEC.

Osuji, F. (1994). *Nigeria: No Man's Environment*. The African Guardian.

Tehbanoglous, G, et al (1971). *Solid Wastes, Engineering, Principles and Management Issues***.** NY: McGraw Hill Book Co.

Uchegbu, S. N. (2002). *Environmental Management and Protection* (second edition). Enugu: Spotlite Publishers.

UNIT 3 POLLUTION PREVENTION IN INDUSTRIES

CONTENTS

1.0 INTRODUCTION

This is s general introduction to an overview of pollution prevention concepts. Here we will look at source reduction, good operating practices, technology change, product change and most importantly, recycling. Observations indicates that most countries now argue for recycling practices because it is very cost effect and environmentally friendly. Happy reading!

2.0 OBJECTIVES

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

- determine an overview of pollution prevention concepts;
- determine source reduction in industries;
- identify good operating practices in industries; and
- illustrate technology changes and pollution prevention.

3.0 MAIN CONTENT

3.1 Overview of Pollution Prevention Concepts

Pollution prevention encompasses both *source reduction* and *in-process recycling*. Source reduction is thus defined as any practice that reduces the amount of any hazardous substance, pollutant, or contaminant entering any waste stream prior to recycling, treatment, or disposal, and

that reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants. Thus governments, businesses and industries, and individuals should prevent or reduce pollution at its source wherever feasible. Where source reduction cannot be achieved, it is advocated that responsible parties reuse and recycle to reduce the quantity of hazardous waste requiring treatment. If there are no feasible pollution prevention alternatives, environmentally sound treatment should be applied with disposal used only as a last resort. Techniques that merely transfer contaminants from one medium to another without a net reduction in the quantity and toxicity of hazardous constituents do not meet the definition of pollution prevention. This unit describes and gives examples of the various pollution prevention measures encompassed in source reduction and recycling.

3.2 Source Reduction in Industries

Source reduction lessens or eliminates the quantity of hazardous and toxic wastes generated and the expense and environmental impacts associated with managing these wastes. In addition, source reduction usually results in significant cost savings realized from raw material conservation. Source reduction encompasses good operating practices, technology changes, input material substitutions, and product changes (Sherry, 1988a).

3.2.1 Good Operating Practices in Industries

In general, industries can realize a high return from a minimal investment by implementing good operating practices. Good operating practices are **procedural, administrative, and institutional measures,** which include improving inventory control, preventing accidental spills, segregating waste streams, and scheduling production runs that maximize production and minimize waste. Getting management to commit to pollution prevention is a first step toward instituting an effective source reduction program. This commitment might be demonstrated by a written policy statement circulated to company employees and posted in visible locations and by encouraging employees to adopt the principles of pollution prevention. Demonstrating management's dedication to pollution prevention and its importance to company operations can galvanize the work force and help employees view pollution prevention as a priority in their everyday work activities. Other management and personnel practices, such as employee training, incentives, and bonuses, also can encourage employees to reduce waste. Maintaining an orderly inventory system and proper storage conditions can greatly reduce material waste from deterioration, inefficient use, and spills. For example, an inventory

system that employs a “first-in/first-out” management method and keeps a 1- or 2-month supply of materials is less likely to result in material disposal because of product expiration. Implementing a material tracking system that tracks material use by individual employees or work groups allows managers to identify individuals or production teams with above-average materials use. Using tight-fitting lids and spill-proof containers with spigots, minimizing traffic, and employing proper environmental controls in storage areas also will extend material supplies and prevent spills. Frequent inventory inspections will result in early detection of leaks and spills. Other good housekeeping practices include containing and reusing materials dripped from parts as they are transferred during a process and providing funnels or other equipment that avoids spills when transferring materials. Regularly scheduled preventative maintenance reduces the occurrence of malfunctions and leaks, which will reduce the volume of wastes discharged to the sewers. Modifying production schedules to minimize required equipment changeovers will reduce the quantity of wastes generated by equipment cleaning. Segregating hazardous and non-hazardous waste streams avoids making the entire waste stream hazardous and reduces the volume of waste requiring treatment or costly disposal. Also, maintaining separate waste streams can enhance the industry’s ability to reuse or reclaim waste materials. For example, by not mixing two different spent solvents, the purity of the waste materials is maintained, making recycling easier.

Another action, often overlooked, is examining the cleaning products (e.g., cleaners, degreasers, and floor finishes) used by a company to determine whether they are contributing to the toxic loadings in wastewater when discharged through sink and floor drains. Cleaning products with toxic constituents can be replaced with substitutes that do not contain harmful elements. A good housekeeping program should include a review of the cleaning products used in house. Many companies use good operating practices as a first step toward reducing toxic materials use (Greiner and Rishard, 1992; Sherry, 1989b).

SELF-ASSESSMENT EXERCISE 1

1. Pollution prevention encompasses both ---------- and ----------
2. Make a list of wastes you are likely to generate from your home and think of an effective source reduction technique to tackle the waste.

3.2.2 Technology Changes

Technology changes can range from minor modifications to existing processes, to major investments in new manufacturing equipment. Technology changes involve changes in any of the following areas:

- Production processes.
- Equipment, layout, or piping.
- Use of automation.
- Process operating conditions, such as flow rates, temperatures, pressures, and residence times.

Production processes can be modified to eliminate the need to change over equipment if a unit can be dedicated to one process. Mechanical methods can be used in lieu of solvent use for cleaning and stripping parts. Various process changes can be implemented to reduce drag-out of process solutions, including adjusting the speed of withdrawal of the part from the process solution, allowing more time for the part to drip, and positioning the part to maximize runoff of the solution. Many companies have experimented with technology changes to prevent pollution.

3.2.3 Input Material Substitutions

This technique involves replacing the input material that contains a problem pollutant with a different material that performs the same function without generating a toxic or hazardous waste. Input material substitutions reduce or eliminate the problem pollutants that enter the production process. Input modifications that avoid the generation of problem wastes during production also fall under this source reduction category. Process changes might sometimes be required to accommodate input material changes. Examples of input material substitution include:

United Piece Dye Works of Edenton, North Carolina, met stringent effluent discharge limits on phosphorous by making chemical substitutions in the production process rather than building expensive treatment systems. The company conducted a detailed evaluation of production processes, process chemistry and the chemicals used to identify sources of phosphorus. It then made process modifications to reduce use of phosphate chemicals by substituting chemicals not containing phosphate. For example, the use of hexametaphosphate was reduced and the use of phosphoric acid was eliminated. These chemical substitutions reduced the level of phosphorus in the company's wastewater from 7.7 mg/l to less than 1 mg/l. This reduction was achieved without any capital expenditures for phosphorus removal (Griener et al, 1992).

SELF-ASSESSMENT EXERCISE 2

Technology changes to aid pollution prevention, involve changes in any of the following areas ----------

3.2.4 Product Changes

A **final** source reduction technique consists of product modifications. By altering the product in such a way that the problem pollutant is no longer required in the production process, businesses can eliminate generating the problem waste. Product modifications also can reduce environmental releases of problem pollutants related to the use of a particular product. Product change generally falls into one of three categories: product substitution (e.g., an entirely new product); changes in product composition (e.g., minor modification to an existing product); and product conservation (e.g., increasing the working life of an existing product). Examples of product changes include:

The paint manufacturing industry has taken steps to reformulate its products to reduce hazardous constituents. Paint manufacturers have continued to improve water-based paints and find applications for them that were previously dominated by solvent-based paints. Water-based paints do not contain toxic or flammable solvents that contribute to the potential hazards of solvent-based paints. The use of water-based paints eliminates discharge to sewers of volatile organics in rinse water from production-line cleaning operations. In addition, volatile organics are not released to the atmosphere by water-based paints (Griener et al, 1992).

3.3 Recycling

Recycling options involve the reuse and reclamation of spent input materials, such as solvents, detergents, inks, and other chemicals. Reuse substitutes spent input materials for new input materials in the manufacturing process. Reclamation, on the other hand, recovers valuable material from spent input materials for incorporation in some other process or product. Recycling can be integrated within the process through a closed loop system or can be conducted separately, using centralized onsite waste recycling systems or commercial materials recyclers. Waste reprocessed or reclaimed can be used on site or sold or given to other businesses for use in their operations. Some states maintain networks to facilitate waste exchanges. The following examples illustrate recycling initiatives:

Mao/a Milk and Ice Cream Company in New Bern, North Carolina, recovers ice cream and milk products for reuse in ice cream products

and animal feed. Initial reuse activities in 1986 prevented the loss of over 17,000 pounds of milk and decreased 5-day biochemical oxygen demand (BODJ by 17,000 pounds over a 4-month period. Soon after Mao/a began recovering milk and ice cream wastes, the City of New Bern's treatment plant showed a 14.7 percent reduction in B0D5 and a 22.8 percent decrease in suspended solids. The recovery and reuse program also has translated into reduced chemical usage, less sludge accumulation, and reduced power requirements for the New Bern treatment plant. In 1988, Mao/a estimated it saved $24,000 per month in wastewater treatment costs and recovered product. Upon full implementation of the reuse and recovery program, Maola hopes to recover as much as 2,410 gallons per day of ice cream ingredient valued at $480,000 annually (Greiner, et al., 1992).

4.0 CONCLUSION

This unit describes several pollution prevention approaches and presents the experiences of several industrial and commercial facilities that have successfully applied pollution prevention methods. By communicating the benefits of pollution prevention to owners and operators of industrial and commercial facilities personnel can motivate facility personnel to seek pollution prevention technical information and assistance.

5.0 SUMMARY

In this unit, we looked at several pollution-prevention techniques, especially those obtainable in industries. Hope you enjoyed your studies. Let us attempt the following questions.

ANSWER TO SELF-ASSESSMENT EXERCISE 2

i. Production processes.
ii. Equipment, layout, or piping.
iii. Use of automation.
iv. Process operating conditions, such as flow rates, temperatures, pressures, and residence times.

6.0 TUTOR-MARKED ASSIGNMENT

Identify the need for good operating practices in pollution prevention.

7.0 REFERENCES/FURTHER READINGS

Greiner, T.J., and P.H. Richard. (1992*). Facility Inspections: Obstacles and Opportunities*. Unpublished.

Santa Clara Valley Nonpoint Source Pollution Control Program. (1991). *Best Management Practices for Automotive-related Industries.* San Jose, CA.

Sherry, S. (1988a). *Minimizing Hazardous Wastes: Regulatory Options for Local Governments.* Sacramento, CA: Local Government Commission.

Sherry, S. (1988b). *Reducing Industrial Toxic Wastes and Discharges: the Role of POTWS.* Sacramento, CA: Local Government Commission.

UNIT 4 ENVIRONMENTAL MANAGEMENT IN NIGERIA: PROBLEMS AND PROSPECTS

CONTENTS

1.0 INTRODUCTION

Environmental management has become one of the greatest challenges facing the world today. Nigeria, in keeping with the global imperatives, shares with the world's increasing concern over the protection and maintenance of the environment. Unfortunately, environmental management was until recently, a neglected theme in Nigeria's development plan (Anjah-Obi, 2000). Indeed, it was the 1987 Koko toxic waste episode in Edo state and the lessons from the 1969-70 Sahelian drought disasters that triggered off unprecedented government action and public support for environmental protection in Nigeria.

Consequently, Nigeria established the Federal Environmental Protection Agency (FEPA) in 1988, charged with the responsibility for protection of the environment and conservation of natural resources within the country. The following year the government also put in place a National Policy on the Environment (NPE, 1989), to secure for all Nigerians a quality environment adequate for their health and well-being. In furtherance of these objectives, the Nigerian government created a full Ministry of Environment in 1999.

Against this background, this unit seeks to highlight some major environmental problems in Nigeria, identify some obstacles to the effective management of the Nigerian environment and suggests the way forward.

2.0 OBJECTIVES

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

- identify environmental problems in Nigeria;
- discuss environmental management in Nigeria; and
- describe environmental management in Nigeria: the way forward.

3.0 MAIN CONTENT

3.1 Environmental Problems in Nigeria

The Nigerian environment has been affected adversely by both natural disasters and human activities. There is evidence that unregulated or unguarded exploitations and excessive consumption of natural resources has inflicted severe damages to the environment (NEST, 1991).

Mining, lumbering, oil exploration, urbanization, agricultural and industrial activities, unsustainable hunting of wildlife air, water and soil pollution, flooding, erosion, deforestation, desertification, and emission of various green house gases are evidences of the adverse effects of continued human activities on the environment in Nigeria (Anijah-Obi, 2000).

3.2 Environmental Management in Nigeria

During the colonial era, sanitation by-laws were strictly enforced and sanitary inspectors carried out regular and surprised inspection of house holds, buildings and premises to ensure compliance. Since independence, the federal government has made efforts in environmental management by providing the legal framework. Thus, policy documents and legislations were made regarding conservation, petroleum oil exploration and control. Examples include:

- Decree No. 11 of 1985 on Endangered Species Control of International Trade and Traffic.
- Decree No. 42 of 1988 on Harmful Waste
- Decree No. 86 of 1992 on Environmental Impact Assessment.

The Nigerian government participated in the United Nations Conference on the problems of the Human Environment held in Stockholm, Swede, in 1972. The result of this was the setting up of a National Advisory Committee on the Environment. This was later replaced by the Environmental Planning and Protection Division of the Federal Ministry of Housing and Environment.

Another initiative was in 1985 when the Government declared the War Against Indiscipline (WAI) and launched the fifth phase of WAI called the 'War Against Filth,' which emphasized environmental sanitation. Environmental task forces and Sanitation Courts were established in all the states and the last Saturday of every month was set aside as National Sanitation Day (Anijah-Obi, 2000). This exercise is carried out every month till date.

Various activities and strategies for better environmental management have been employed. They ranged from environmental exhibitions, posters, school competitions, seminars, workshops, clean-up campaigns, radio jingles, tree planting campaigns, etc.

Non-governmental Organizations (NGOs) have also made significant contributions towards awareness creation and environmental management in Nigeria. Among the numerous NGOs in this area are:

- The Nigeria Conservation Foundation (NCF)
- Nigerian Environmental Study and Action Team (NEST)
- The Nigeria Environmental Watch (NEW)
- Women in Enviro-Care (We-Care)
- SAJJU Institute and Research Foundation
- Environmental Rights Action (ERA)
- Niger Delta Wetlands Centre (NDWC)
- Foundation for Environment and Education in Nigeria (FEDEN)

SELF-ASSESSMENT EXERCISE

Make a list of environmental problems in Nigeria

3.3 Environmental Management in Nigeria: The Way Forward

Environmental management should be seen as a strategy by which human activities that affects the environment are organized so as to maximize social well-being and mitigate potential problems or hazards by tackling its root causes. Environmental issues should therefore not be seen in isolation, they should be addressed together with the process of development especially as they relate to population growth, rational use of natural resources and environmental protection and conservation.
Therefore, to manage the Nigerian environment, the following considerations by Anijah-Obi (2000), could be helpful:

- Environmental education and information should form part of everyday policies and activities.

- Women should be encouraged to participate in environmental management.

- Local community involvement in environmental management process in both the rural and urban areas is highly desirable.

- Government should intensify its population control efforts especially at the grassroots level.

- Poverty alleviation should be given priority attention in Nigeria as poverty has been implicated as both a cause and effect of environmental degradation.

- Urbanization should be adequately managed to minimize environmental problems.

- Industrial compliance with environmental regulations should be ensured.

- Environmental management measures in the areas of – reforestation, waste disposal, erosion control etc, should be intensified.

4.0 CONCLUSION

We have seen that environmental problems in Nigeria are diverse in nature and are of significant dimensions. Environmental management measures put in place in Nigeria is a clear demonstration of the need to protect the environment, though more effort is needed in this area.

5.0 SUMMARY

This unit looked at environmental problems and management in Nigeria, as well as decrees and legislations put in place to aid the health of the citizens in relation to environment. It finally highlighted certain measures that could aid the way forward on environmental management in Nigeria. Hope you enjoyed this unit. Now, let us attempt the questions below.

ANSWER TO SELF-ASSESSMENT EXERCISE

- Incessant mining and lumbering
- Harmful oil exploration
- Unchecked urbanization
- Agricultural and industrial wastes
- Unsustainable hunting of wildlife
- Air, water and soil pollution
- Flooding and erosion
- Deforestation and desertification

6.0 TUTOR-MARKED ASSIGNMENT

1. Give a list of environmental related NGOs in Nigeria
2. Identify the way forward for environmental management in Nigeria
3. List the Decrees put in place by Nigerian government to aid environmental management.

7.0 REFERENCES/FURTHER READINGS

Anijah-Obi, F. (2000). *Environmental Management in Nigeria: Problems and Prospects.* In H. I. Ajaegbu, B. J. Matthew-Daniel and O. E. Uya (Eds). *Nigeria: A People United, a Future Assured* Vol 1(A Compendium). Federal Ministry of Information: Gubabo Pub. Co.

(1996). Environmental Crisis: An Overview. In P. Alozie (ed), *Technology, Science and Environment: A Current Overview of Nigeria*. Aba: Vitalis Press.

Nigerian Environmental Study/Action Team (NEST), (1991). *Nigeria's Threatened Environment: A National Profile,* NEST: Ibadan.

Uchegbu, S. N. (2002). *Environmental Management and Protection* (second edition). Enugu: Spotlite Publishers.