UNIT 15 THE ENVIRONMENT AND HUMAN HEALTH—II

Structure

15.1 INTRODUCTION

In the previous unit on Environment and Human Health—I, we have covered the potential health hazards that may result from biological and chemical contaminants in food and water. In this unit, we will continue our discussion and see the effects of air pollution, occupational environment, stress and radiation on health.

We begin with air pollution and health. While discussing health effects of various pollutants that are now common in most industrial towns and metropolitan cities, we will explain how they affect the different parts of the respiratory system and result in respiratory diseases. Many kinds of pollutants generated from the industry get mixed in the air. Workers breathing in such an environment are exposed to potential risk to health. Thousands of workers die annually due to occupational diseases. Therefore, we will examine the working environment of miners, factory workers and others who constantly breathe contaminated air, and focus on their health problems. Constant exposure to high-level noise originating during heavy machinery work, transportation, loud music, etc. are also harmful for health.

Stress is yet another aspect arising out of the surrounding environment. It contributes towards many chronic health problems. Among the environmental hazards the most dangerous is radiation. People all over the world are in fear of man-made radiation, which may arise from nuclear power plants and nuclear weapons. You know that in the past, several people have been affected by radioactive fallout resulting from atomic bomb explosions, nuclear testing and accidents in nuclear power plants. The effects of radiation last for several generations. We will also look into the various diseases prevalent in our country due to mismanaged environment. In addition, you will be apprised with the current health picture in our country. In the end, we will look into the options available to us for safeguarding our health.

Objectives

After reading this unit you should be able to :

- explain how air pollutants affect our respiratory system,
- relate various respiratory diseases with the air pollutants and indicate the extent of such diseases in the country,
- give examples of occupation-related diseases from your area and identify affected people in some cases,
- outline noise-related health problems and list some categories of persons prone to them,
- list stress-generating factors and establish with examples the relationship between

stress and disease,

- discuss health hazards due to radiation,
- state the major killer and debilitating diseases in the country.

15.2 AIR POLLUTION AND HEALTH

Air pollution is a growing threat to health throughout the world. It was considered a great threat after the terrible incidence of epidemics of asthma in USA and Japan in 1955 and death of about 4,000 people in London in 1952. In India, Bhopal gas tragedy alerted the country to the dangers of air pollution. You have already read about some of the consequences of this tragedy in Block one Unit 1 of this course. No amount of money in compensation from Union Carbide can reverse the ill effects on the health of affected people.

Air pollution reduces the quality of air we breath by limiting the availability of oxygen. Besides, we are forced to breathe in substances that are harmful to lungs. We often experience that exposure to smoke or fine dust immediately causes irritation to eyes, nose, throat, etc. while other pollutants may cause watering of eyes, burning in and blocking of nose, sneezing and headache. This may be followed by irritation in throat, change in voice, dry cough, and so on. Some gases on deeper penetration cause irritable cough, difficulty in breathing, increased rate of respiration and other severe problems that may be fatal. These are the acute effects which are immediately manifested after exposure to pollutants. Various studies have shown that most air pollutants cause respiratory problems. Long exposure may result in diseases like emphysema, bronchitis, chronic cough and asthma.

Smoggy polluted air also contributes to serious health problems such as allergies, and heart diseases. One of the components of smog is carbon monoxide which on breathing interferes with the binding of oxygen to haemoglobin in red blood cells. You may have experienced an after-headache when caught in a traffic jam or travelling on a busy road for a long time. This is due to the increase in the levels of carbon monoxide in heavily congested traffic. The levels may increase indoors due to cigarette smoking. That is why smoking is harmful also to the people around the smoker because 'the second hand smoke' is inhaled by them. You are familiar with other air pollutants such as oxides of nitrogen, lead, hydrocarbons, particulate matter produced by automobile exhaust, and sulphur dioxide produced on burning of coal or oil containing sulphur. In Table 15.1 are given the health effects of these pollutants. Perhaps, you may not be familiar with the names of many diseases given in the Table. We will tell you about them later in this section.

Let us now see how our respiratory system reacts and signals when exposed to a pollutant. We feel this knowledge is pertinent as it would help you to (i) identify the quality of air in your surroundings and (ii) recognise early warning signals of forthcoming health problems.

Table 15.1 : Effects of Major Air Pollutants on Health

Pollutant	Effects on Health
Oxides of sulphur	Cause cough, choking, irritation to mucous lining of lungs, shortness of breath, tissue fluid accumulation, chronic bronchitis, pulmonary fibrosis, acute and chronic asthama and emphysema
Oxides of nitrogen	Cause irritation to eyes, reduce the oxygen carrying capacity of blood, diminish pulmonary function and cause edema of respiratory tract
Carbon monoxide	Asphyxiation, heart and brain damage, impaired perception, increased resistance to blood flow, weakness, fatigue and headache
Photochemical oxidant, e.g., ozone	Sore eyes, coughing and soreness in chest, decreased pulmonary function, emphysema, fibrosis, aging of lungs and respiratory tissue, and right heart failure
Benzopyrene	Death due to cancer
Tobacco Smoke	Causes cancer
Particulate matter	The effect depends upon the nature and size of particulate matter. Cause irritation, alter immune defence, decrease in pulmonary function, stress on heart and affect lungs

To understand these problems, you should first know the various parts of the respiratory system, its defence mechanism, and its response to pollutants or other invaders.

The Respiratory System

Let us first revise what you have learnt about the respiratory system in school. A gross morphology of the system is drawn in Fig.15.1. Try to label its parts. After completion, check it with the answers given in the box below.

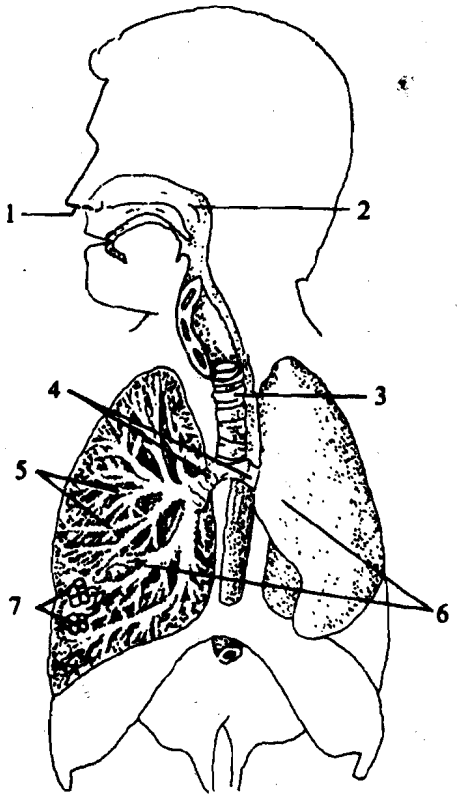


Fig. 15.1 : Respiratory System

Parts of Respiratory system

1) nose, 2) nasal passage, 3) trachea, 4) bronchi, 5) bronchioles, 6) lungs, and 7) alveoli.

Fig. 15.2 in the margin shows detailed structure of alveolar sacs which function collectively as the organs of gas exchange with environment. These are lined by a thin membrane which is surrounded by many blood capillaries. The alveoli are filled with inhaled air.

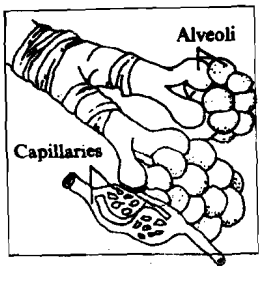


Fig. 15.2 : Detail Structure of Alveoli

Defences against Pollutants

The respiratory tract is all along equipped with a built-in defense mechanism which guards against particulate and gaseous pollutants. These are :

i) nasal hair,

ii) nasal passage,

iii) mucous membrane lining the respiratory tract (from nose into the upper portion of bronchial tree),

iv) tiny hair lining the upper and lower portions of the respiratory tract and

v) the engulfing cells in the alveoli. Lower respiratory tract is important for respiratory functions and is safeguarded by the upper respiratory tract.

Body's response to Pollutants

When particulate matter or a toxic gas enters the nose it crosses these barriers

before it finally settles in the lung. While passing through, it may irritate, inflame or damage the area of contact. First, it is obstructed in the nose by nasal hair, which function like an air filter used in cars, air conditioners, furnaces, etc. These particles are later blown out from the nose or are swallowed. If a harmful gas is breathed in, it may be absorbed quickly by the nasal passage so as to prevent the entry further down to more delicate and important parts like bronchioles. In severe attacks the mucous in the respiratory tract helps to wash away the irritants. Running nose, cough and sneezes, blown out sputum and even tears from eyes are speeded up to expel the irritant. In addition, the cilia lining the respiratory tract work to carry mucous and trapped particles up and out of the respiratory tract. These are eventually expelled or swallowed. Finally, if the invader succeeds in reaching the bronchioles or alveoli, then the engulfing cells digest it or push it back to the respiratory tract. Engulfing cells can kill bacteria only. But the particulate insoluble matter like dust, carbon, asbestos, etc. is deposited in the lungs, whereas the soluble matter like metal fumes enter the blood and is carried to other sites, where it may accumulate. In either case, the pollutants many damage or kill many cells.

Years of breathing polluted air and smoking tobacco can weaken and destroy cilia, alveoli and lung tissues.

Consequences

The sudden death of cells in a short time leads to secondary effects. The dead cells release harmful substances that cause blood capillaries to expand and water to come out of the capillaries. The water accumulates in the nearby tissues, making them swollen. If it accumulates in bronchioles or alveoli, the rate of gas exchange by lungs reduces. In other words, lesser amount of oxygen reaches the lungs for delivery to the body. In turn, the heart is affected because it has to work harder to cope with oxygen stress. It must be pointed out that decrease in exchanges of air by lungs or any obstruction in exhaling or inhaling of air results in respiratory diseases.

Although all parts of the respiratory system work hard to eliminate a pollutant, long-term exposure or excess give rise to acute and chronic irritation, inflammation, excessive mucous production and impairment of lung function. The symptoms manifest themselves in diseases such as bronchospasm, chronic bronchitis, aggravated asthma, emphysema and the pneumoconiosis. These are briefly described below:

1. Bronchospasm

When the muscles of bronchioles are inflammed due to excessive irritation by pollutants, bronchioles get obstructed (Fig. 15.3a). Hence, the expulsion of air from the lungs is obstructed. This condition is called **Bronchospasm.**

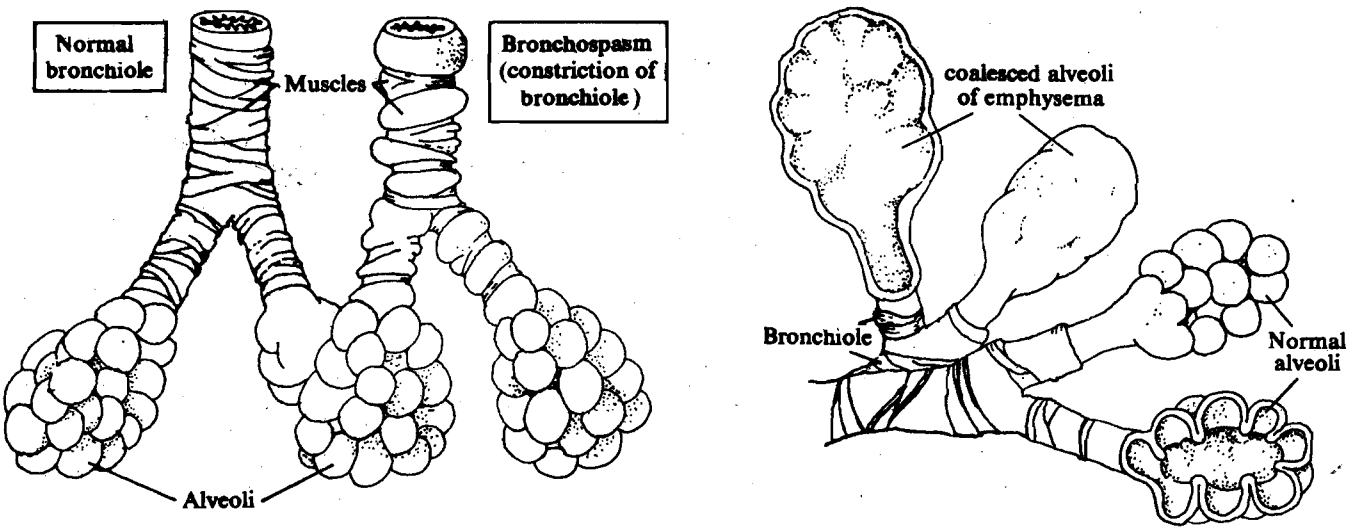


Fig. 15.3 : a) Condition of bronchioles in bronchospasm, b) Diagrammatic representation of emphysema.

2. Chronic Bronchitis
This is due to the inflammation and edema of the lining of bronchi. The symptoms are increased mucous production and chronic coughing. In severe cases small bronchioles are destroyed. Chronic bronchitis can lead to emphysema.

3. Emphysema
The walls of alveoli breakdown and individual alveoli join together into larger sacs as shown in Fig. 15.3b. This reduces the total surface area available for the exchange of gases in the lungs.

4. Pulmonary Fibrosis
Since dust cannot be eliminated by the macrophages in alveoli, it tends to stay in place over many years and some fibrous tissue is deposited around it. This is termed as fibrosis which decreases the function of the lungs.

5. Chronic and Aggravated Asthma
Asthma is an allergic condition usually triggered by foreign substances and some emotional overlay. The disease is marked by narrowing of airways caused by bronchospasm. So the air is literally trapped in the lungs because it cannot be expelled. Irritant pollutants such as particulate matter — flour, coal, talc, asbestos dust, etc. aggravate asthma. They eventually lead to a chronic condition. Breathing becomes difficult in severe cases and often continuous condition leads to death.

6. Dust Diseases (Pneumoconioses)
These are caused by inhaling dust.of certain types of pollutants of size ranging from 0.5 to 5 μm. In most cases, the victims are either exposed at the work place or in its surroundings. The severe dust diseases are listed in Table 15.2.

Table 15.2 : Dust Diseases

Diseases	Causes
Silicosis	Silicon
Byssinosis (brown lung)	Cotton fibre, flax, hemp
Bagassosis	Sugarcane fibre
Asbestosis	Asbestos fibre
Anthrocosis (black lung)	Coal dust
Talcosis	Talc

As we have told you before, if dust stays in the respiratory system for many years, fibrosis of tissue results which decreases the function of lungs. This in turn puts stress on the heart. In its advanced stage, the patient suffers breathlessness all the time and eventually dies. Such effects depend on.

i) chemical composition of dust,

ii) fineness or dust particle size,

iii) concentration of dust in the air,

iv) period of exposure, and

v) health status of the person exposed.

So, we can conclude that health effects of air pollution are very severe and prolonged exposure to toxic pollutant may be fatal. Diseases like chronic bronchitis, bronchospasm, chronic cough, emphysema and aggravated asthma, pulmonary fibrosis, lung cancer, etc. cause a lot of misery as long as the person lives. And he is relieved only after death. In the following section on occupational health, you will learn that long exposure of air pollutants is mainly due to the environment in which some unfortunate people have to work.

Before we move on to the next section on occupation and health, you many like to try the following SAQs.

SAQ 1

a) Match the respiratory impairments listed in column 1 with the corresponding diseases in column 2.

Column 1		Column 2	
a)	Increased mucous production and chronic coughing	i)	Emphysema
b)	Inflammation of muscles of bronchioles	ii)	Chronic bronchitis
c)	Breakdown of alveoli to form large sacs	iii)	Aggravated asthma
d)	Deposition of fibrous tissue around the particulate pollutant in the lungs	iv)	Bronchospasm
e)	Trapping of the air in the lungs	v)	Pneumoconiosis

b) Fill in the blanks with appropriate words

i) Smoggy polluted air contributes to..... .....and.....
.....

15.3 OCCUPATION AND HEALTH

For most people, the choice of job is limited. The poor and the underprivileged people who have been doing most risky and hazardous jobs and living in the dirtiest of environments suffer from many of the diseases discussed above. But the people who work in offices in a comfortable environment are not free of diseases either. They suffer from physical illness and psychological stress which, in fact, is the root cause of many health problems. Studies have shown that exposure to toxic chemicals and physical agents in working environment contribute to lung diseases, heart diseases, skin disorders, cancer, hearing loss, etc. Diseases occurring due to deterioration of environment at working site are known as occupational diseases. In the following two sub-section we will discuss these diseases.

15.3.1 Working Environment and Health

In this sub-section, we will tell you about the diseases that result due to working in factories, mines, agricultural lands, offices, etc. Noise-related diseases will be discussed in a separate sub-section. In the present century, the incidence of these diseases is on the rise due to ever-increasing industrialisation.

1) Mining and Factory Work

In the previous section on air pollution, we have told you about the dust diseases known as pneumoconioses. Dust particles or chemical dust evolved during mining or in any processing at the working site is inhaled by workers daily for several years. This adds up to thousands of hours of exposure for a worker. Hence, these workers are prone to getting respiratory diseases.

In India, silicosis was first reported from the Kolar Gold Mines (Mysore) in 1947. Since then its occurrence has been uncovered in various other industries. It is common in people working in coal, gold, silver, lead, zinc, manganese, and other metal mining industries, pottery and ceramic industry, iron and steel industries, sand blasting and building construction work and several others. In Bihar, the incidence of pneumoconiosis in mica industries was found to be upto 34% and in ceramic industry 15%. As we have mentioned before, another major illness byssinosis, is common among textile workers who work in the bale opening room, carding room, blow room and the winding and the spinning room. Workers inhale allergenic pollutants while working and get nose and throat diseases and also ear diseases. Some cases of cancer of nose and throat have been noted in workers in chemical factory. It is feared that high levels of exposure to some factory chemicals my even result in death.

According to a study prepared for US National Institute for Occupational Safety and Health, the hazardous industries are ranked as shown in the margin. The ranking in the study was based on (i) the relative toxicity of the carcinogen involved and (ii) the extent of exposure to them by the workers.

In India, several home industries operate in unorganised private sector where people

The Most Hazardous Industries (Cancer causing chemicals used are given in brackets)

1. Industrial and scientific instruments (asbestos, lead, solder)
2. Fabricated metal products (lead, nickel, asbestos, certain solvents)
3. Electrical equipment and supplies (lead, asbestos, mercury, chlorohydrocarbons, certain solvents)
4. Machinery (except electrical : cutting, quenching and lubricating oils)
5. Transportation equipment (ingredients of plastics, including formaldehyde and phenol)
6. Petroleum and petroleum products (benzene, naphthalene)
7. Leather products (chrome salts and organic compounds used in tanning of hides)
8. Pipeline transportation (petroleum derivatives, metals used in welding)

work in the most unhealthy conditions. Due to lack of adequate space, light, ventilation and safety measures, they fall prey to many diseases. For example, workers in welding industry suffer from early blindness and respiratory diseases, in flour mills, from lung diseases; in sift industry from ear, nose and throat diseases; in paprika industry from lung disease called paprikosis; and in tobacco factories from lung diseases and allergic skin diseases.

We will discuss the health problems due to high level of noise in the following sub-section. Constant exposure to noise produces noise-induced (nerve) deafness. This is common in workers attending boiler section or sand blasting process or heavy engineering sections. Ladies working as telephone operators suffer from deafness after several years.

carcinogens—chemicals that cause cancer.

Some of the occupational problems are due to lack of awareness and negligence. For instance, most workers do not use goggles while working with bright light or gloves while handling carcinogenic chemicals. Therefore, they are often exposed to bright light and get eye diseases and become eventually blind. Carcinogenic chemicals cause cancer which is common in dyers, tanners, painters and in people working in chemical industries. You have learnt about the effects of toxic chemicals in the previous unit.

2) Agricultural Field Work

Methylisocyanate (MIC) that caused mass poisoning in Bhopal has been used in manufacturing the pesticides—carbaryl (Sevin) aldicarb (Temik)

Nowadays farmers use various kinds of chemicals as insecticides or pesticides such as diazinon, malathion, carbaryl (Sevin), aldicarb (Temik) etc. to protect plants. Chlordane is widely used to control termite infestations and 2,4-D is generally used to kill weeds. Due to exposure to such chemicals, farmers suffer from neurological paralytic diseases or toxic poisoning or cancer. It is observed that women working on such farms invariably suffer from irregular menses, abortions, cancer and give birth to abnormal children.

3) Office Work

Persons working in offices suffer from diseases of spine, backache and spondilytis. This could be due to use of uncomfortable furniture and abnormal sitting posture.

4) Working habits

Personal habits during working hours play a great role in deciding health of an individual. In India, quite a few people of U.P. and Bihar chew tobacco mixed with lime. Some of the workers in textile factories are misled to believe that by chewing tobacco and chuna they will not get constant cough or other disorders of lungs. Workers smoking cigarettes as relief during working hours, may get cancer of lung. Tea and coffee are taken in excess routinely by people working in offices. These beverages, though stimulants, are habit-forming and are harmful to health. Tea causes acidity in the stomach.

Workers from chemical factories do not use gloves while handling hazardous carcinogenic materials, they do not take a bath or wash their hands before taking meals. As a result they ingest hazardous chemicals and suffer from several diseases due to toxic poisoning by lead, mercury, etc. Negligence or lack of knowledge of good house-keeping at the shop floor or work site, produces accidents causing minor injuries, fractures and even death. Unhygenic habits leading to chemical contact with skin produces eczema, allergic diseases of skin, e.g. chronic ulcer of skin and machine oil dermatitis of hands.

5) Travel

Persons who drive fast, and do not take a break or use protective and preventive aids are likely to be involved in accidents. Continuous travel increases stress on body and the person may suffer from high blood pressure, problems like indigestion, hyperacidity, and so on.

6) Irregular Timings

Many people work in night shifts. This duty is often by rotation, it changes a person's physiological rhythms, who may suffer from insomnia, indigestion, headache, high blood pressure and irritability. Such symptoms make the worker inefficient or might even force him to remain absent from work.

7) Other Professions

People working in laboratories handling various infective material may suffer from hepatitis (jaundice) or diseases like AIDS. Some of them handle substances containing radioactive isotopes or carcinogens. Consequently, they are subject to risks discussed earlier.

Finally the work atmosphere, expectation of the employer, interpersonal relations, pressure of work, etc. may lead to stress and cause illness. We will tell you in detail about stress-related illnesses in the following section. It is seen that a majority of the occupational diseases damage body organs permanently.

15.3.2 Noise-Induced Diseases

This century has rightly been called as the 'century of noise.' Because of heavy industrialisation we are exposed to a high level of noise all around us. Noise has become a very important 'stress factor' in modern life. It leads to many health hazards. Some of the sources of noise pollution are aircraft, automobiles, factories, loud speakers during public speeches or festival celebrations, pop and Rock-n-Roll music in clubs. The effect of noise on health depends on both loudness and frequency. Any source producing sound levels of more than 80 to 90 dB for more than eight hours is harmful to human ear. Frequency of sound is denoted by Hertz, Hz. One Hz is equal to one cycle per second. Human ear can hear frequencies between 20 to 20,000 Hz. This range is reduced with age or due to some other factors. The frequencies below 20 Hz are **infrasonic** or inaudible and the frequencies above 20,000 Hz are **ultrasonic** and also inaudible to human ear.

The sound intensity, its frequency and hearing ability can be measured by instruments. The intensity is measured in dB by 'Sound Level Meter', the frequency (i.e. high or low pitch of sound) by 'Octave Band Frequency Analyser' and the hearing ability of a person by an 'Audiometer.' It also helps in detecting the extent of loss of hearing with respect to various frequencies for the correct assessment of the type of deafness.

Effect of noise on human health depends on the following three main factors : i) quality, ii) duration and iii) sensitivity of the individual. Noise produces the following three main effects.

1) Psychological

Noise leads to emotional disturbances which, however, are difficult to measure. Noise effects are often manifested in annoyance. Irrespective of its intensity, noise disturbs sleep, e.g., a dripping tap or traffic rumble, while irritating noise at work place reduces concentration, efficiency and working capacity.

2) Masking Effect

A masking noise prevents the ear from registering other important sounds and signals. Such effects increase the risk of accidents on workshop floor of heavy engineering industries or of automobiles.

3) Physiological Effects

These are of two kinds : auditory and non-auditory

Auditory Effects

i) Auditory fatigue : This occurs when the level of noise is in the range of 85-90 dB, for example, noise of a food blender. It is greatest when the frequency of noise is 4000 Hz. It may be associated with side effects, such as whistling and buzzing in the ears.

ii) Deafness or impaired hearing : This is a serious problem. It may be temporary or permanent. Temporary hearing loss occurs on continuous exposure to noise as in the case of telephone operators. But this disability disappears within 24 hours after a period of rest. However, repeated or continuous exposure to noise level of more than 90 dB may result in permanent loss of hearing. Persons who have ear diseases, discharging ear or impaired hearing since childhood due to some progressive disease are usually more prone to permanent ill effects on hearing than others. Hence, persons having ear diseases should avoid noisy working environment.

Non-auditory Effects

i) Interference with speech and communication : When the high level of noise is around, a person needs to strain his voice by increasing loudness to make speech intelligible; for example, in foundries, boiler cabins, etc. Sometimes street hawkers or salesmen of small stalls in busy markets also continuously yell their product and its price. Such workers suffer from voice disorder or even cancer of voice box in later part of their lives.

ii) Annoyance : Most people are annoyed by noise but neurotics are more sensitive than balanced people. Neurotic people lose their temper quickly and become irritable.

iii) Efficiency : Low level noise is acceptable to most people. Quiet environment helps in increasing the work output. Reverse is true in high-level-noise working environment. It reduces the working efficiency.

iv) General change in the body : Rise in blood pressure, pulse rate, breathing and sweating or headache may occur on exposure to noise. Giddiness, nausea, fatigue, disturbed sleep, defective colour perception and reduced night vision are general symptoms observed in victims. Persons working in night shifts or persons already suffering from essential hypertension get victimised by noise exposure earlier than others.

SAQ 2

a) Write in column 1 the kind of health problems the people are likely to suffer, to the corresponding working environment given in column 2.

Column 1		Column 2
a)	i)	Mining
b)	ii)	Textile Industry
c)	iii)	Continuous desk work
d)	iv)	Excessive travelling
e)	v)	Handling pesticides
f)	vi)	Working in night shifts
g)	vii)	Dyeing, painting

b) Fill in the blank spaces with appropriate words.

i) Telephone operators may suffer from, ...
.....of .....

ii) High level of noise in general affects....., ...
and causes.....

iii) ..... can occur in heavy engineering industry due to..... effect of noise.

iv) ..... of noise has worse ill effects on persons who have .....
.....or.....since.....

15.4 STRESS AND HEALTH

Nowadays people are confronted with innumerable stressful situations. Stress leads to many disorders. It has also been observed that stress is an important factor in diseases such as neurosis, coronary heart diseases, gastric ulcer, higher blood pressure, allergies, asthma and many other.

15.4.1 Environmental Stress Factors

The environmental factors which produce stress can be categorised as— i) physical and ii) psychological. Stress factors in physical environment are noise, vibration, temperature, light, etc. These produce stress and can cause various health hazards and degrade the quality of life. The psychological factors are very important and are created by social environment and poor economic conditions.

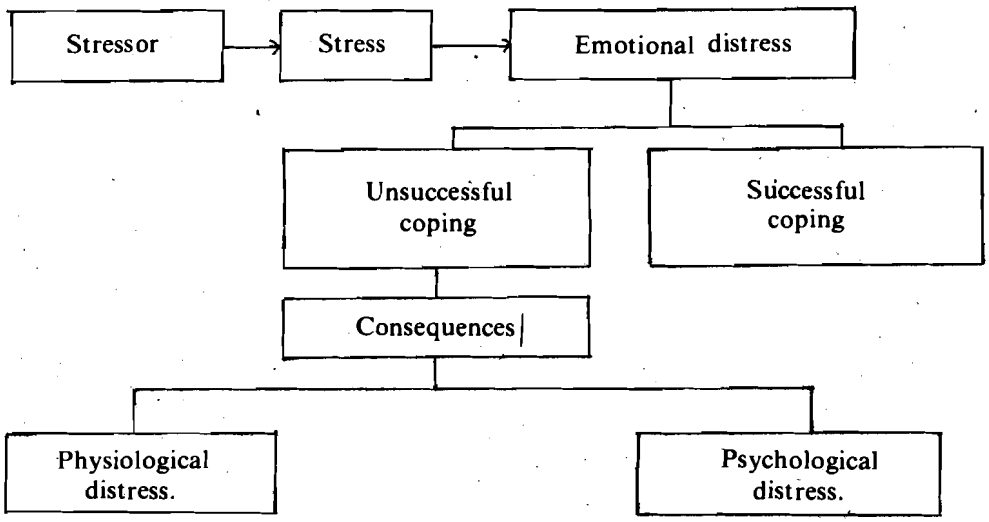
We live in an environment that provides us with never-ending array of challenges throughout life. These may be accomplishing daily tasks or achieving a set goal in life—such as getting good marks in exams, striving for a specific career, trying to win a competition or even looking for a job.

In addition, there are emotional challenges like maintaining relationships, finding a life partner, or putting up with uncompromising people. We are under stress while coping with such challenges. Other psychological conditions that can cause stress are poverty, unemployment, death of close relatives, inter-group prejudices and tensions, migration to culturally different countries and so on. Stress also arises from monotony, machine pacing highly skilled repetitive work, noisy atmosphere and so on.

Studies have shown that air traffic controllers are under stress due to constantly worrying about aeroplane crashes and collisions. They often suffer from peptic ulcer.

During stress we experience negative feelings — anxiety, depression, sadness, fear and anger, which may result in physical illnesses like headache, sleeplessness, stomach upset and muscular tension. This means that negative feelings trigger a disruption in our state of psychological balance which in turn affects our physiological response to stress. In other words, stress causes a breakdown of the harmony between mind and body.

The stimulus that causes stress is known as a stressor and the reactions or symptoms it causes is stress. The stressors are circumstances and events that disrupt the harmony between mind and body. In the following diagram we show how stress can lead to health disorders.



15.4.2 Stress-related Diseases

Normally people deal with stress routinely in everyday life. But prolonged unresolved stress situations can contribute to several kinds of stress-related illnesses. During emotional distress the nervous system, the endocrine system and the immune system get activated. For instance, under stress our endocrine system produces more epinephrine—a hormone and the blood pressure rises. In fact, these systems keep on working under normal physiological conditions and also enable one to cope with short-term stressful events. However, under prolonged stress, they are continuously activated and health problems begin. But illness may not appear until long after the initial effect of the stressor. The immune system is affected partly by long-term activation of nervous and endocrine system. Its normal functioning is impaired. Hence, a person's susceptibility to disease increases during stress. You may have observed that when people are emotionally upset, they fall sick easily. For example, certain students get cough, cold and fever during examination period. When people are unsuccessful in coping with stress and it becomes unmanageable, adverse reactions occur. These are psychological and physiological distress as given below.

1) **Psychological and Behavioural effects**—anxiety, depression, fatigue, frustration, shame, irritability, bad temper, low self esteem leading to accident proneness, drug taking, alcohol drinking, smoking, impaired speech, nervous laughter, restlessness and trembling. In extreme cases a person may even contemplate committing suicide. Other effects could be inability to take decisions, lack of concentration, frequent forgetfulness, hypersensitivity to criticism, and mental block.

2) **Physiological and Health effects**—increased blood pressure and heart rate, dryness of mouth, sweating, lump in throat, tingling and numbness in limbs.

Health problems such as asthma, heart attack, dyspepsia, ulcers, headache, insomnia, loss of sexual interest, weakness, diabetes mellitus, skin disorders, eczema, vasomotor rhinitis.

3) **Organisational effects**—absenteeism, high accident rate, poor production, antagonism at work and job dissatisfaction.

SAQ 3

List two main stressors that contribute to stress in your life. What are your physical o. emotional stress reactions to these?

.....

.....

.....

.....

.....

.....

15.5 RADIATION AND HEALTH

You know that doctors use X-rays for diagnosis of various health problems. The X-rays are a kind of radiation much like visible light but with much more energy. You have already been told about; α(alpha), β, (beta), and γ(gamma) radiations which also have high energy. Perhaps, you know that ultraviolet radiation is also harmful. When such high energy radiations strike human body, they penetrate the tissue, and transfer their energy as they pass through it. Table 15.3 shows the effects of different radiations on the body. The energy of radiation damages the molecules in the cells. If certain key molecules of the living cells are affected, cellular functions are disrupted and the cells may die. Sometimes, the damage is repaired immediately, but often it shows up years later. This happens when the DNA molecule which contains all the genetic information required for functioning and maintenance of the cell is affected. If the DNA molecules in the germ cells are altered, the effect may by passed on to the next generation.

Table 15.3 : Different Types of Radiation and their Effect on the Body

α and β radiations are particulate in nature. That is why they are also called α-particles and β-particles

Types of Radiation	Effect on the Body
1) α-particles	Can travel in air only a few centimeters, and in living tissues only 30 μm (i.e. can cross about 3 cells). Generally cannot penetrate the skin. Entry to the body parts such as bones or lungs, results in irrepairable damage.
2) β-particles	Can travel in air about 8 cm and in tissue about 1 cm. Can penetrate the skin but do not reach underlying tissues. Cause damage to the skin, skin cancer and eye cataract.
3) γ radiation	Can travel about hundred metres in air and can easily penetrate the body and pass through it.
4) X-rays	Can travel extremely far, and pass through the body tissue except bones. Cause damage to the molecules in cells.
5) ultra violet rays	Have relatively lower energy than X-rays. Can cause skin cancer.

The rad and the rem are gradually being replaced by new international units, the grey and sievert (1 grey = 100 rad and 1 sievert = 100 rems).

The extent of damage depends upon exposure to the amount of radiation and is measured in units of rads (radiation absorbed doses). One rad is equal to 100 ergs of energy deposited per gram of tissue. The rate of transfer of energy to the tissue is also important. This is called linear energy transfer (LET). It is the amount of energy

transferred per unit of distance the radiation travels into the tissue. Alpha particles travel slowly, so they transfer more energy than, α, β and X-rays that travel faster.

Another unit rem (roentgen equivalent man), which takes into account linear energy transfer, is used to measure radiation exposure. It indirectly indicates the damage that a given amount of radiation will cause in the tissue. Rad and rem are essentially equivalent for X-rays, β-rays, and γ-rays but for α-particles 1 rad is equivalent to 10 to 20 rems. Exposures below 5 to 10 rems/year are generally considered low level.

The effects of radiation on health depend upon the following factors: i) the type of radiation, ii) the energy of radiation, iii) the amount of radiation, iv) age of individua and v) external and internal exposure.

Ionising radiations may produce in human beings and in fact, in all living organisms including plants, the following three types of biological effects:

1) Carcinogenic effects — cause cancer. The probability of getting most forms of cancer is increased by ionising radiation.
2) Mutagenic effects — cause a change in genetic material that is then passed on to progeny.
3) Teratogenic effects — defects in the development of embryo which cause birth defects.

These three types of defects are also produced by chemical agents and accordingly the chemicals are called carcinogenic, mutagenic and teratogenic.

In addition it has been found out that i) fetuses are most sensitive to radiation, and children are more sensitive than adults, ii) cells in tissues undergoing rapid cellular division are highly sensitive to radiation. We are all exposed to natural ionizing radiation which on average is in the range of about 80-100 rem/year. Therefore, in nature such biological effects are spontaneous and bring about change in genetic make up of organisms. In fact, there is ample evidence to suggest that life on this planet evolved due to ionizing radiation. That they are a great threat to human beings now may sound ironical.

All forms of radiations α, β, γ and X-rays have enough energy to rip off outer shell electrons from the atoms to form ions, so they are called ionizing radiations.

Although radiation exposure is not common and its hazards may remain localised to some extent, the risk is feared due to accidents in nuclear power plants and use of nuclear weapons. As has been witnessed in the past, such hazards can spread on to a large area and have far-reaching consequences to a large population.

For obvious reasons, the effects of radiations cannot be studied on human beings. Therefore, most studies have been conducted on animals using very high or low doses of radiation. The results give us some idea of their various harmful effects but they cannot be extrapolated to human beings. Moreover, radiation effects may be manifested after several generations. Presently, a lot of information is obtained by studying the people who have been exposed to either low or high level radiation years earlier. Low level radiation is used for medical diagnosis and for the treatment of certain diseases. It is shown that even such exposures carry with them a certain degree of risk. In recent decades, there has been a marked increase in people's overall radiation exposure, especially for certain occupational groups: uranium miners, watch dial painters, patients treated with radiations, survivors from atomic bomb explosions, technicians working with X-rays and in nuclear power plants, and people working with radioisotopes, etc.

The radium watch dial painters routinely tipped the end of the brush in mouth before applying paint to the dial face. In later years these workers experienced a very high incidence to bone tumor.

In the beginning of this century, malignant tumors were detected for the first time on the hands of radiologists and scientists using X-ray machines or radium. A high incidence of leukemia, three to four times higher than in the general population, was detected in them years later. Since the dangers of radiation were not known, early workers were careless in handling radioactive material. Radiotherapy was commonly used in 1945 for patients suffering from ankylosing spondilitis, children having tonsils and women having breast ailments or lung tuberculosis. The effects of radiation appeared years later. Some of these findings have been listed in Table 15.4.

Table 15.4 : Effects of Low-level Radiation

Exposure	Effects observed years later
Radiation therapy for acne, spinal disorder and syphilis	Elevated risk of leukemia
Radiation therapy for mastitis (an inflammatory ailment in breast), and lung tuberculosis in women	Breast cancer
Medical X-ray of neck or radiation therapy to shrink tonsils or treat chest ailment in children	Cancer of thryroid gland, salivary gland tumor
Uranium and fluorspar (Calcium flouride) miners exposed to radon gas	Lung cancer
Watch dial and aeroplane instrument painters (paint containing radium)	Bone cancer, aplastic anaemia (a serious diseases of bone marrow)
Pregnant mothers exposed to diagnostic X-ray (2 to 3 rads)	Children born show 50% higher rates of leukemia, tumors of lymphatic system, brain tumor and other types of cancer
Exposure due to nuclear testing	Higher mortality rates in children and also in adults

In Australia 2 out of every 3 person who live up to 70 suffer from skin cancer at least once in their life time. The high incidence of cancer is directly related to the depletion of ozone (4.9 to 10.6 per cent) sunscreen over South Australia that allow more ultraviolet radiation to penetrate the earth surface. The ozone hole in Australia, as big as the United States and as deep as Mount Everest is causing scare in the continent of Australia.

Now it has been seen that continuous low-level radiation is not safe as it has a cumulative effect. A statistical study conducted in the USA showed that frequent medical X-rays may make a person ten times more susceptible to getting leukemia.

Ultraviolet radiations also cause skin cancer. A high incidence of skin cancer on the exposed skin has been observed specially among light-coloured populations living in the equatorial region. Dark skin contains special pigments malanin which absorb much of the UV radiation and prevents it from penetrating to DNA of the living cells. UV radiation is rapidly absorbed by water in living tissue and so does not penetrate beyond the skin.

High level exposure to radiation is rare. The effects of lethal, sub-lethal and non-lethal radiation have been investigated on the survivors of Hiroshima and Nagasaki. These findings are summarised in Table 15.5. Since the effects of radiations are often manifested in the offspring, it is difficult to estimate the number of generations in which they will show up in the victim. Besides the victims suffer socially. The survivors of Nagasaki and Hiroshima are called bibakusha (the bombed ones). They are ostracised when it comes to marriages.

Table 15.5 : Effects of High-level Radiation

Dose	Effect
Dose of 650 rads (High lethal dose)	Kills within a few hours to a few days
300 rads (Lethal dose)	Kills one-half of the population within 60 days
50-200 rads (sublethal dose)	Not immediate death, suffer from radiation sickness
Immediate effect After 2 to 14 days	Fatigue, nausea, vomitting diarrhoea and loss of hair, reduction in blood platelets, sore throat, recovery is possible within a few days of exposure
General delayed effects On mothers	Cancer, leukemia, cataract, sterility, decreased lifespan In mother — increase in spontaneous abortion, still births, early infant death

SAQ 4

a) i) Can you tell why infants and children are more sensitive to radiation than adults?

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ii) Why do the effects of radiation pass on to the next generation?

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iii) Why are X-ray more harmful than ultraviolet rays?

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b) Which among the following statements are true? Write T for true and F for false in the boxes.

i) Cells that multiply rapidly are most affected by radiation. ☐

ii) The sensitivity to radiation in human beings is in the order of adults > children > fetuses. ☐

iii) The effects of radiation are often manifested after several generations. ☐

iv) Low-level radiation used in the diagnosis of diseases is absolutely harmless. ☐

c) The high incidence of the following diseases was observed many years later in the group of people who were exposed to radiation. Match the group of people listed in column 1 with the diseases listed in column 2.

	Group of people		Diseases
i)	Children exposed to radiation for treatment of tonsilitis	a)	Leukemia
ii)	Uranium and fluorspar miners	b)	Cancer of thyroid gland
iii)	Radiologists	c)	Bone cancer
iv)	People using paint containing radium	d)	Lung cancer

15.6 CANCER

Cancer is not a new disease as is wrongly believed. However, these days its incidence is on the rise. At present about 20 to 25% of the human population in the world die of cancer and it is feared that in future it might become the greatest enemy of mankind.

The term cancer was introduced by the famous Greek physician Hippocrates who is called Father of Medicine. Cancer in Latin means crab like. The disease creeps in all directions through the body, eventually cutting off life with its pincers.

Cancer is uncontrolled division of cells in the body. Any part of the body — skin, lungs, brain, bone marrow, ovary, or stomach can become cancerous. Normally, division of every cell is regulated for proper development and functioning. When cells loose this control, repeated cell division leads to a mass of abnormal cells — called tumor. A tumor does not have any function in body. Instead, wherever it starts, due to rapid growth, it occupies a lot of space and pushes aside the tissues and organs around it. It draws their nutrients, and thus obstructs their vital function.

According to National Institute for Occupational Safety and Health (USA) the ten most hazardous chemicals causing cancer are in the order, asbestos, formaldehyde, benzene, lead, kerosene, nickel, chromium, "volatiles" in coal tar, carbon tetrachloride, and sulphuric acid.

Tumors are of two types, benign and malignant. Benign tumors multiply slowly and are confined to a site. Cysts, moles, warts and polyps are benign tumors. But there is a risk that they may turn into malignant forms. Malignant tumors multiply rapidly and later some of the cells may detach from them and migrate into other vital organs via blood stream and form new tumors there. This stage is called **metastasis** or **secondary stage.** Cancer does not develop abruptly. It is the cumulative result of the effects of an agent on the body for several years or decades. Many risk factors such as radiation, chemicals in the environment, genetic predisposition, nutritional factors,

Excessive intake of calories or fats, obesity and nutritional deficiencies especially of vitamin A and lack of roughage can cause cancer.

immunological deficiencies, stress and negative mental state may induce or contribute to the development of cancer. It may also be induced by some viruses. Only 20 to 40% of all cancers are caused by hazardous conditions at the work place and other environmental pollutants. The rest are the result of natural cellular changes.

There are four categories of cancer as described below:

1) **Carcinomas**—the cancers originating from skin, membranes around glands, nerves, breasts, lining of respiratory, urinary and digestive tracts.

2) **Sarcomas**—cancers originating from connective tissues, bones, muscles, fat and blood vessels.

3) **Leukemias**—cancer of the organs and tissues, lymph glands bone marrow, etc. that form blood cells, causing an over production of immature white blood cells.

4) **Lymphomas**—Cancers similar to leukemia leading to abnormal production of white blood cells by the spleen and lymph system.

15.7 SMOKING, ALCOHOL AND DRUGS

People who smoke, drink or take drugs introduce harmful chemicals into their body. Tobacco smoke besides nicotine, contains many toxic chemicals such as acetone, acrolein, carbon monoxide, methanol, ammonia, oxides of nitrogen, hydrogen sulphide, traces of various mineral elements, traces of radioactive elements, acids, insecticides and other substances. Small particles in smoke contribute to yellowish brown residue of tobacco known as tar. Smoke also contains carcinogenic chemicals and radioactive isotopes of the element polonium. Actually, radioactive lead is a constituent of soil which on breakdown forms radioactive polonium. The latter gets deposited on the sticky leaf hair on tobacco leaves and thus becomes a part of smoke. Perhaps, you are aware that habitual smokers suffer from chronic cough, continual sputum production and difficulty in breathing. It has been shown that smoking is linked with bronchitis, emphysema, cancer of larynx, oral cavity, oesophagus, and bladder, stomach and duodenal ulcers, cirrhosis of liver, and heart diseases. A high incidence of prenatal and postnatal mortality has been observed in babies born to mothers who smoke during pregnancy. Also the babies are generally born underweight.

Alcohol abuse is one of the common health related problems. In India, the habit is more prevalent among people of the weaker sections of our society. Intake of alcohol depresses the central nervous system. It affects the part of the brain which controls speech, thinking, movement and other mental functions. That is why after drinking a person loses memory, judgement, concentration, inhibition and self control. High intake results in progressive deterioration of speech, vision, coordination, hearing and walking. Besides, wide fluctuations in mood may occur: the initial euphoria may turn into depression. Alcohol is much more dangerous when used with drugs like tranquilisers, aspirin, sleeping pills, etc. because of synergetic effects. Alcohol also affects liver, kidneys and parts of digestive system.

Progressive degeneration of liver known as cirrhosis is common in alcoholics. It also damages stomach lining and thus causes ulcers. The infants born to women who drink habitually show heart anomaly, facial disfiguration, and intellectual impairment. They are also smaller in size than normal infants. They may have physical addiction to alcohol called **fetal alcoholic syndrome.**

Drugs are chemical substances that are medically prescribed to relieve pain, fight infection, cure illness or to maintain good health. However, in common usage these substances are called medicines and the terms drugs implies to substances that are taken to change mood and perception, to increase pleasurable sensation and even as a means of escape from life problems temporarily. We are sure that you must have heard about drugs like cocaine, marijuana, hashish (brown sugar), LSD, heroin, etc. Since these drugs affect the central nervous system they are called psychoactive drugs. They alter the physical and mental functions and debilitate the body.

The biggest danger of using such drugs is addiction or physical dependence which means the compulsive use of drug to an extent that it seriously impairs the user's capacity to lead a normal life. Moreover, withdrawal symptoms occur if the addict tries to abstain from using it. In some television documentaries you may have seen the pathetic state of such drug addicts due to withdrawal symptoms. Most of these drugs cause psychological dependence to the extent that in order to buy them which requires a large sum of money, the users commit crimes. Otherwise, there is no connection as such between the drugs and crimes as is wrongly believed. Since the sale and use of these drugs is banned all the dealings are underhand and clandestine. The big money involved leads to organised crime — a sort of Mafia of drug dealers and peddlers, spanning various countries and even the continents.

It is unfortunate that a large percentage of youngsters all over the world are victims of drug abuse. The situation is getting alarming in India also. Though the marketing and use of drugs is illegal but certain greedy people commit the heinous crime of coaxing and selling drugs to youngsters who are the future of our nation. Therefore, it is necessary to create an atmosphere that will change the attitude of our people. The youngsters need direction for a reorientation towards constructive work and towards facing and coping with the adversities of life bravely.

Indiscriminate use of drugs has become increasingly common in recent years. In some instances, the side effects and dangerous complications of drugs become evident only when it is too late. We will illustrate this point by narrating you the classic case study of a tragic incident that occurred due to a sedative drug— thalidomide.

In the 1950s and 1960s, the drug was in use as an active ingredient in tranquilisers and sleeping pills in West Germany, England and many other countries. Children and adults were given the drug with no noticeable side effects. The drug was also prescribed to pregnant mothers. In the 1960s several thousand babies were born all over the world with rare congenital birth defects. The babies had deformed arms or legs, and eye or ear defects. Later, investigations revealed that the mothers of affected children had taken thalidomide during pregnancy. We have mentioned earlier that chemicals that cause birth defects in developing embryos are called teratogens. Other suspected teratogens are antibiotics — tetracyclin and streptomycin, alcohol, sex steroids, lithium, etc.

SAQ 5

a) Which among the following statements are true? Write T for true and F for false in the boxes.

i) Polluted environment has been responsible for a new group of diseases known as cancer. ☐

ii) Metastasis is the advanced stage of cancer. ☐

iii) Certain foods may cause cancer. ☐

b) What kind to risk is feared in babies born to mothers who smoke?

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c) List three major diseases caused by excessive smoking?

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d) In the following statements fill in the blanks with appropriate words.

i) Smoke contains.....chemical and .....elements.

ii) Drinking of alcohol by pregnant women results in birth defects and physical.....in babies known as.....

iii) Drugs that cause defects in the development of embryo are called.....

iv) One should not take .....or .....along with alcohol.

15.8 HEALTH PICTURE IN THE COUNTRY

You have studied in detail the health implications of our changing environment. The introduction of pollutants in environment has posed a threat to human health and well-being. Hence, our generation is faced with many new diseases. In this section we highlight the changing profile of killer and debilitating diseases and the current status of health in India.

15.8.1 Changing Profile of Diseases

You know that industrialisation has expanded like a mushroom in many parts of India. Urbanisation is rapidly increasing. With the growth of industry, the rural population has been migrating towards the nearest industrial zones.

Our rural population has three major enemies as per the World Health Organisations definition, i.e. poverty, poor nutrition and parasitic infestations. With this background, the newly migrated working population have low vitality, and hence are more susceptible to the adverse health effects and industrial pollutants. Migrants stay in unhygenic over-crowded slum areas which often lack sanitation and proper housing. Quite often they cannot afford to bring along their families. This results in alcoholism, addiction to drugs and prostitution, which, in turn, leads to deterioration of their health and increased morbidity. They succumb easily to killing diseases like tuberculosis, heart diseases and cancer.

Present Health Status in India

India with a population of 84.4 crore (1991) is the second most populous country in the world. The gross birth rate has come down from 33.3 (1978) to 24 (1981) per thousand. But, the general death rate has also come down from 27.4/1000 in 1951 to 14/1000 in 1980. However, there are large inter-state variations. Information on causes of death is however, incomplete.

Morbidity Profile

The morbidity pattern in the last decade has not changed much. The principal causes of morbidity are the same in large part of our population. These are discussed briefly below:

a) **Infective and parasitic diseases**—These are responsible for 60% of admission in General Hospitals, though some diseases like small-pox have been eradicated or are under control. Polio or viral hepatitis occurred frequently in 1973 and there were large scale outbreak of Japanese Encephalitis. Incidence of bacterial diseases like cholera has declined but that of other water-borne diseases like diarrohea and dysenterry has not decreased. The prevalence of Tuberculosis continues to be high with an estimate of 8-10 million cases. Our country has 1/3 of all the leprosy cases in the world. Tetanus and diptheria are much under control in urban areas due to good immunisation, but parasitic infestation and sexually transmitted diseases are still on the increase.

b) **Malnutrition**—Very large population in India is malnourished and anaemic. Lack of vitamin 'A' leads to blindness; similarly lack of iodine in salt leads to endemic goiter. It is noted that malnourishment in India is not due to poor resources or technology, but is largely social and managerial in origin.

c) **Non-communicable diseases**—Like most of the heart diseases, cancer, blindness, deafness are positively posing a threat in certain social groups. Occupational diseases like silicosis, bagassosis are on the increase. Allergic disorders are increasing day by day. Surveys show sickness load is 7 to 13% in rural population.

15.9 FUTURE WELL-BEING OF MANKIND

In these two units you have learnt that the only way to achieve good health is by keeping the quality of environment high. In fact, the concept of close association

between disease and the environment is not new. The relationship of environment to health has been recognised since the ancient times. Now the philosophy of holistic health is being revived. Such a view recognises the interrelationship of the physical, psychological, emotional, social, spiritual and other environmental factors that contribute to overall health and quality of a person's life. Disease is a complicated interaction between man and environment. Not long ago, human beings were victims of epidemics of plague, smallpox, cholera, influenza, etc. over which they had little control. Advances in science and technology during the 19th century have helped to understand these diseases and find their control. It was found that the spread of these diseases is linked with the environment.

As we have discussed above that because of deteriorating environment the present and the future generations are in danger of being affected by new types of health problems. Hence, appropriate measures need to be taken immediately. However, the options we can exercise are rather limited and not clear-cut since they entail both costs and benefits.

In recent years, there has been much concern about the alleged indifference to impact on environmental quality in many World Bank developmental projects.

Having read the earlier chapters, you must have realised the kind of dilemma faced by many developing nations regarding the choice between development and quality of environment. While every human being has a right to a life of good quality, whether it can be achieved without degrading the environment is the critical question. For example, higher rate of power consumption that is taken as an index of the quality of life, by some Western standards, call for more and more power plants which will have an adverse effect on environmental quality, unless suitable measures are taken. Another example that we can quote is Brazil. Until recently, economic prosperity was being achieved only by destroying the unique Amazonian forest endangering the global climate pattern. The imperatives of the moment are sustainable development, which implies development keeping in view the environmental concern and constraints.

The demands of modern life, it appears, cannot be met without compromising the quality of 'internal' environment. Let us take an example. Many of the serious ailments are due to the life style people have. One kind of situation arises from highly competitive culture, imitating our western counterparts, the so called rat race that brings physical comfort no doubt, but also tensions, worries about work, career, economic status, etc. You have learnt that tensions, worries and frustration can also predispose people for stress-related illnesses. In the other group are people who may not have stress due to the reasons mentioned above but because of lack of proper nutrition, poverty and ignorance buffer from various types of physical as well as psychological illness.

By internal environment here we mean the physical and psychological state of the body

In conclusion, we want to emphasise that the situation is bad, but not hopeless. The solutions, however, are not easy. In the last unit of this course we will discuss what sort of measures can be taken for sustainable development so that our environment does not deteriorate.

15.10 SUMMARY

In this unit you have learnt that:

- Respiratory problems such as chronic bronchitis, chronic cough, pulmonary fibrosis, emphysema, aggravated asthma and pneumoconiosis are linked with air pollution. Inhalation of carcinogenic chemicals causes cancer.
- Our respiratory system responds immediately to pollutants. Some of the responses are: sneezing irritation in throat, cough, increased mucous production, difficulty in breathing, etc.
- Long exposure to pollutants in working environment causes respiratory diseases in workers in their later life. Workers in mining, textile, pottery and ceramic, sand blasting, chemical and in many other such industries often suffer from respiratory problems and cancer. While people working in offices may suffer from backache, spondilytis, hypertension, high blood pressure, etc. constant exposure to high level of noise causes various auditory defects and also stress.

- Stress due to physical or social environment triggers diseases such as asthma, ulcers, diabetes, hypertension, depression, schizophrenia, etc. Behavioural abnormalities like excessive drinking and smoking or drugs are also due to stress.
- Studies on low and high-level radiation exposure show that effects of high level radiation are severe. In addition, low-level radiation is also harmful though its effects appear years later.
- Incidence of cancer is on the rise due to increased production of carcinogenic chemicals and ionising radiations. Cancer is also linked with smoking. Inhalation of 'secondhand' smoke by non-smokers is equally harmful and causes health problems similar to those faced by smokers.
- Indiscriminate intake of drugs, alcohol or smoking during pregnancy is extremely harmful for the foetus.
- The health statistics of India show that diseases caused by infective and parasitic infestations are still rampant and the efforts for their eradication have not been very successful. Now new killer diseases are also on the rise, due to the deterioration of environment.
- The future well-being of mankind depends on a strategy of development which does not endanger environment.

15.11 TERMINAL QUESTIONS

1) Make a list of harmful chemicals and other environmental agents that people most commonly are exposed to.

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2) Efforts to eradicate infective and parasitic infestations in India have not been very successful. What do you think are the obstacles?

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3) Survey your locality and make a list of people whose living environment or working conditions may lead to some serious health problems.

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15.12 ANSWERS

Self Assessment Questions

1) a) a) ii, b) iv, c) i, d) v, e) iii.

b) respiratory diseases, allergies and heart problems.

2) a) Pneumoconiosis b) Byssinosis c) Backache and spondilytis d) High blood pressure, indigestion hyperacidity e) Neurological paralytic diseases, f) Insomnia, high blood pressure, g) Cancer of skin

b) i) temporary loss of hearing
ii) concentration, efficiency, annoyance
iii) Accident, masking
iv) High level, ear disease, impaired hearing, discharging of ear, childhood.

3) Some of the common stressors are:
Job pressure, money problems, dislike for work, relationship with co-workers, relationship with family members, career aspirations, physically uncomfortable living.

Some of the common stress reactions are:
Hypertension, headache, fatigue, wheezing, rapid heart rate, constipation, insomnia, skin rashes, stomach cramps, dizziness, nervous tics and itches.

4) a) i) Radiation affects cell division which is maximum in the developing organism. Since infants and children are at developing stage they are more sensitive than adults.

ii) Radiation can cause changes in DNA molecule which may show up as mutation that may be replicated. If this change occurs in the DNA of the germ cells, it may be passed on to the next generation.

iii) X-rays cause relatively more damage to the tissue than UV radiation because they have higher energy.

b) i) T, ii) F, iii) T, iv) F

c) i) b, ii) d, iii) a, iv) c

5) a) i) F ii) T iii) T

b) Increase in death rate of babies before or after the birth.

c) i) Respiratory diseases – bronchitis, emphysema, cancer of larynx.

ii) Heart diseases

iii) Ulcer of stomach and duodenum

d) i) Carcinogenic, radioactive, ii) addiction to alcohol, fetal alcohol syndrome, iii) teratogens, iv) tranquilisers, aspirin.

Terminal Questions

1) Cigarette or tobacco smoke, smoke from coal, household pesticides, kerosene, X-rays, coal dust, silicon dust, automobile exhaust etc.

2) The obstacles are : poverty, poor nutrition, ignorance, illiteracy, insanitary conditions, limited choices, lack of medical facilities. You are expected to elaborate in the answer how one obstacle is linked with other.

3) Some of the people are : Traffic police at the crossing, drivers, persons operating flour mills, workers at construction site, painters, welders, dyers, telephone operators, sedentary overweight people managing a small shop, etc.