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## ENVIRONMENT AND HEALTH

It is well known that various human activities have caused damage to land, air, water and organisms that inhabit them. The degraded environment in turn poses a serious threat to affect human health and social well-being.

In developing countries like India the biological contamination of food, water and air with germs has remained a health menace. Introduction of toxic chemicals and harmful radiations has created new types of potentially serious health problems. Developmental projects have led to pollution of the environment resulting in different type of health problems. Some of those will be discussed in detail in this lesson.



### OBJECTIVES

After completing this lesson, you will be able to:

- *define health and various types of influences (genetic, behavioural, environmental);*
- *list and describe the problems of sanitation in habitations (village/town/city);*
- *differentiate between different modes of spreading of water borne diseases, caused by pathogens, vectors and chemical pollutants;*
- *describe certain water borne diseases, how they spread and consequences thereof;*
- *prepare inventories of dominant air pollutants in agricultural, cottage and large industrial and mining areas and congested townships;*
- *cite examples of the environmental carcinogens and methods of their control;*
- *list the diseases caused due to heavy metal toxicity and methods of their prevention;*
- *list different kinds of occupational health hazards;*
- *explain different ways, by which humans get exposed to air pollution hazards while working in mines, textile, cement, chemical and paper industries.*

**Notes****11.1 HEALTH AND VARIOUS TYPES OF INFLUENCES**

Health of a person is the result of interaction of a large number of influences upon the person. These can be considered as **genetic** influences, **behavioural** influences and **environmental** influences.

**Genetic influences-** Genes determine the physical and physiological characteristics of an organism. The inherited abnormalities manifest as the hereditary diseases which are passed on from parents to offsprings. Diseases like allergies, hypertension, diabetes, etc. are not entirely genetic. However, they are due to the interaction of genes with the environment. These are triggered and affected by nutrition, stress, emotion, hormones, drugs and other environmental interactions.

**Behavioural influences** – Alcoholism, smoking, use of drugs, tobacco chewing or irregular food habits causing various kinds of health problems.

**Environmental influences-** Various components of the environment exert their influence on our health. These can be grouped under physical, chemical, biological, sociological and psychological factors.

**11.2 SANITATION AND OTHER PROBLEMS IN HABITATIONS**

- Unregulated growth of habitations, inadequate infrastructure facilities and lack of proper facilities for collection, transportation, treatment and disposal of wastes have all contributed to increased pollution causing health hazards.
- Lack of proper toilets, especially in villages, towns and slum areas of cities does not permit proper disposal of human waste which in turn leads to improper sanitary conditions and health hazards.
- Scarcity of clean drinking water is one of the major causes for the spread of many water borne diseases.
- Poor drainage or improper drainage results in the accumulation of waste water in public places in villages, towns and cities. Animal excreta and movement of cattle in and out of water pools and puddles spreads this filth over larger areas further causing sanitary problems.
- Contamination of food, often due to lack of understanding of the reasons and consequences is another health hazard faced by humans.
- Poor personal hygiene and eating without washing of hands leads to many types of health problems.



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### 11.2.1 Villages

One of the major problems of the villages is the lack of safe drinking water supply. Many health problems and diseases in villages are due to use of water which is not clean. Improper disposal or lack of disposal of excreta adds to the sanitation problems. These are linked with high infant mortality rate and low life expectancy. Provision of low cost sanitary latrines in villages is a very important program of rural development. Ignorance of hygiene and sanitation adds to the problems further. Dissemination of knowledge and provision of safe drinking water is an important agenda. Rural households are not properly ventilated as a result they suffer from lack of fresh air and many rural households are single room units which get filled with smoke from burning of fire wood and biomass and do not get adequate sun light. They lack of proper drainage that leads to contamination of ground water and other sources of drinking water.

### 11.2.2 Towns

In most of the cities there is lack of proper drainage. As a result accumulation of waste water form puddles of dirty water. Animals like cattle, dogs and pigs roam freely in cities and their excreta etc. make sanitation problems worse. Roads are not proper and the different types of transport further pollute the environment and cause health problems.



*Fig. 11.1: Frequent traffic chaos in a city*

### 11.2.3 Cities

Rapid growth of urbanization has adversely stressed the environment. About  $1/5^{\text{th}}$  of the urban population resides in slums and  $1/3^{\text{rd}}$  of the population does not have access to sanitation and clean drinking water which results in poor health. Most cities have many



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unplanned and haphazard areas with inadequate infrastructure. Industrial areas have been established without environmental assessment. Inadequate commercial areas, inadequate transport network, inadequate green and recreational areas and lack of consideration for environment in planning have led to chaos and environmental degradation. Discharge of sewage into open drains, contaminate city water supply, especially during rainy season.

- (a) **Slums-** Are unplanned aggregations of hutments arranged very closely without any space for roads, parks, drains, etc. Often many persons live in each of these small hutments which do not have proper ventilation and cooking on wood burning chullahs fills them with smoke resulting in many respiratory problems and diseases. Generally toilets are absent making life difficult especially for women. Lack of proper drainage leads to very unhygienic conditions. Due to unavailability of clean drinking water, these people suffer from diseases like dysentery which is often fatal to children in these areas.
- (b) **Industrial areas-** Many industries are established in unplanned manner and without environmental impact assessment. This results in air, water, soil and noise pollution with their undesirable consequences. The industrial effluents and waste are often hazardous and may contain toxic heavy metals and other toxic materials some of which ultimately to leach down and contaminate ground water making it unfit for drinking and other use.
- (c) **Residential and commercial areas-** It is very common in cities to have commercial activities in areas meant exclusively for residential purposes. Since these are unplanned there is no proper infrastructure for these activities. There is lot of over crowding in a confined area. Haphazard parking makes movement of traffic and people difficult. The noise level is high especially because of hawkers selling their wares at a very loud pitch so as to attract the attention of the prospective customers. Daily generation of garbage- both domestic and commercial is often dumped at the roadside making the whole area filled with filth and unhygienic. Burning of tree leaves and plant residues also leads to air pollution especially during winters.
- (d) **Traffic-** Most often the traffic is chaotic due to inadequate roads, poor enforcement of traffic rules, too many vehicles and lack of proper public transport. The movement of vehicles leads to atmospheric pollution due to the emission from the vehicles, suspended particulate matter and smoke especially from diesel vehicles.



## INTEXT QUESTIONS 11.1

1. Define health.
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2. What is the advantage of providing potable water (drinking water) to the community?

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3. What are slums?

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4. State any two reasons for health problems in villages?

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### 11.3 DIFFERENT MODES OF SPREAD OF WATER RELATED DISEASES CAUSED BY PATHOGENS, VECTORS AND CHEMICAL POLLUTANTS

At least 1/5<sup>th</sup> of world population lacks access to safe drinking water. In developing countries, 80 to 90% of the untreated sewage is discharged directly into rivers and streams which provide water for drinking, washing and bathing. Lack of sewage treatment allows pathogenic organisms to spread water-borne diseases. Diseases transmitted by vectors like mosquitoes which live in the water are responsible for about one third of all deaths in the world.

The growing pollution of rivers and other water bodies constitutes a very big threat to public health. Polluted waters lead to various gastrointestinal problems, liver infection, cancer, etc. Large number of children die because of diarrhoea.

#### 11.3.1 Modes of transmission of diseases

Disease causing pathogens reach humans in various ways which are described below.

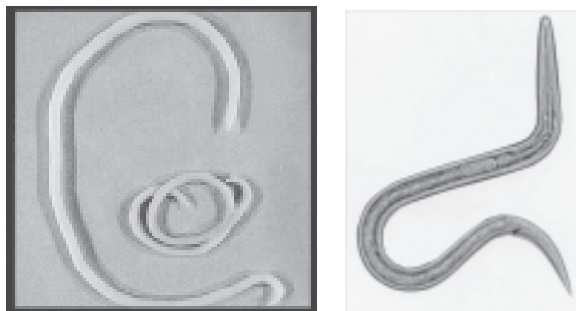
- Contact transmission:** Some diseases can be transmitted by either direct physical contact with the infected person or the causative agent can be transmitted to the host indirectly by contact with the infected articles.
- Vehicle transmission:** (a) Pathogenic organisms are transmitted through water, food, etc. When the water is infected at the source, it spreads the infection to large populations. Pathogens causing Cholera, Typhoid and Hepatitis are transmitted from one person to another through their domestic water supply. Infection is also transmitted by organisms which live in water e.g. Helminthes (parasitic worms) which spend part of their life cycle in water.  
(b) Many chemical pollutants such as food additives, adulterants, poisonous industrial waste, pesticides and metals get mixed with water including underground water and are consumed by humans and animals resulting in diseases. Inadequate water supply and lack of personal hygiene cause transmission of disease such as trachoma in the eye and skin infections.
- Vector transmission:** Vector is a carrier of pathogen. Mosquito spend a part of their life cycle in water. Vector for diseases such as malaria, yellow fever, encephalitis, filaria and dengue.



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**11.3.2 Water borne diseases, their spread and consequences**

It is estimated that 73 million work days are lost every year in India due to water related diseases. India is rich in rivers and surface flow represents 97% of the available water. But rather than being a boon, these rivers are proving to be quite a disaster because of pollution. River Yamuna becomes highly polluted after entering Delhi due to the addition of untreated sewage, industrial waste and many other pollutants. It has been found that water samples taken in Delhi are about 20 times more polluted than the water samples taken before the river enters Delhi. Water borne diseases are spread by drinking water contaminated by faeces, by water used for personal hygiene, for washing food and other items. Diseases are spread by poor quality water used for washing and include skin diseases like scabies and eye disease such as trachoma and conjunctivitis. Water based diseases spread by parasites living in water include schistosomiasis transmitted by snails. Disease from polluted water include hook worm, round worm, etc. (Fig. 11.2)



*Fig. 11.2: Pathogens of water borne diseases*

A large number of diseases are transmitted in different ways by water. The diseases caused, mode of transmission and symptoms are tabulated below.

*Table 11.1: Water-borne diseases*

**A. Bacterial diseases:**

Disease	Causative organism	Mode of spread	Symptoms
Typhoid	<i>Salmonella typhi</i>	Contaminated food, water, milk, unwashed raw vegetables and flies	Continuous fever which increases day by day Temperature higher in evening than morning, body ache, headache and constipation. Haemorrhage from an ulceration in small intestine
Cholera	<i>Vibrio cholerae</i>	Water or food contaminated by bacteria from stools of cholera patient	Painless diarrhoea , vomiting, 30-40 stools per day which soon becomes typically watery and colourless with flakes of mucous floating in them



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Bacterial Diarrhoea	<i>Shigella</i> spp.	Contaminated food, water and by direct personal contact	Diarrhoea, with blood and dysentery mucous in the stools along with severe gripping pain in the abdomen. Stools not too frequent (4-10 per day), faecal matter scanty. Patient looks ill
Leptospirosis	<i>Leptospira</i>	Rodents primary hosts-carry organ- isms in kidneys. Infection by wading or swimming in water contaminated with rodent urine	Fever, pain in legs, nausea, vomiting are common, congestion of the conjunctival blood vessels around corneas of the eyes

**B. Viral diseases:**

Infective Hepatitis	<i>Hepatitis virus</i>	Food and water contaminated with virus in stools	Loss of appetite, nausea, vomiting and diarrhoea, accompanied with fever. Urine dark coloured. Eye and skin appear yellow
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**C. Protozoan diseases:**

Amoebic dysentery	<i>Entamoeba histolytica</i>	Ingestion of cysts in food and water	Abdominal discomfort and diarrhoea, with or without blood or mucous in stools, fever, chills and gripping pain in abdomen
Diarrhoea	<i>Giardia (=Lambia) intestinalis</i>	Food or water con- taminated with fae- ces having cysts	Intestinal disorders leading to epigastric pain, abdominal discomfort, loss of appetite, headache and loose bowels

**D. Helminth diseases:**

Bilharzia	<i>Schistosoma</i> spp	Cercaria larvae of flukes in water penetrate skin of persons wading in water	Allergy-like itch, rash, aches, fever, eosinophilia etc. When infection heavy, eggs may block arterioles of lungs cardio-pulmonary water causing schistosomiasis and may lead to congestive heart failure
Guinea worm	<i>Dracunculus medinensis</i>	Unfiltered water	Blister near the ankle, causing allergy and aches

**E. Vector borne diseases related with water:**

Diseases transmitted by mosquitoes-

Disease	Causative Organisms	Vector	Hosts	Symptoms
Malaria	<i>Plasmodium</i> sp	Female Anopheles (primary or final hosts)	Man (inter- mediate hosts)	Shivering, chills and sweating. As chills subside body temperature rises as high as 106° F. When temperature comes down patient sweats profusely and becomes comfortable until next attack which takes place at regular intervals
Filaria (Elephantiasis)	<i>Wuchereria (=filaria)</i>	<i>Culex fatigans</i>	Man (final hosts)	Enlargement of limbs and scrotum
Dengue	Barbo - virus	<i>Aedes aegypti</i>	Man (reservoir)	Sudden onset of moderately high fever, excruciating joint pain, intense pain behind eyes, a second rise in temp following brief remission, reduction in neutrophilic white blood cells



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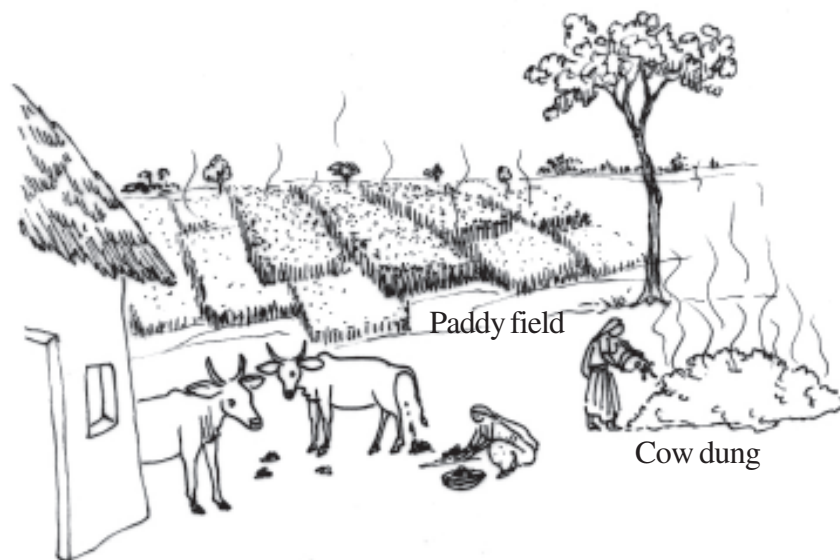
**INTEXT QUESTIONS 11.2**

1. State one example of disease transmitted by vector.  
\_\_\_\_\_
2. Diarrhoea with or without blood or mucous in stools, fever and gripping pain in abdomen are all symptoms of a water borne aliment. Name it.  
\_\_\_\_\_
3. Name the bacteria which causes Leptospirosis.  
\_\_\_\_\_

**11.4 AIR POLLUTANTS ASSOCIATED WITH AGRICULTURE, INDUSTRY, MINING AND URBAN AREAS**

Atmospheric pollution is an ever-increasing threat to health throughout the world especially in developing countries like India. Air pollution spoils the quality of air that we breathe. Many substances which are harmful to lungs are carried by such inspired air. Air pollutants cause irritation to eyes, burning sensation in eyes, blocking of nose, sneezing and headache etc. There are others which cause more serious problems which in some cases can be fatal. Long exposures to air pollution can cause diseases such as bronchitis, chronic cough, asthma and emphysema.

**11.4.1 Air Pollution from agricultural operations**



*Fig. 11.3: Cattle defecating and methane release from cow dung as well as from paddy field*





- **Pesticides** – A significant proportion of pesticides applied to crops is vapourized and contaminates the atmosphere over agricultural fields.
- **Smoke** – Burning of crop residues results in production of smoke and many toxic gases.
- **Water vapour** – The humidity in agricultural fields especially after irrigation is generally high. In addition to the above, toxic gases are also released from the use of machinery such as diesel pumps, tractors etc. contaminate agricultural areas.

#### 11.4.2 Industrial

- **Smoke** – Smoke is perhaps the major pollutant in industrial areas caused due to burning of fossil fuels such as coal. The chimney belches out dense clouds of pollutants which coat the surrounding areas with a thick layer of white dust or ash (Fig. 11.4).



*Fig. 11.4: Factory chimney emitting thick cloud of smoke and settling of fly ash*

- **Carbon dioxide** – Burning of fossil fuel, wood and crop residues all produce lot of carbon dioxide leading to global warming and climate change.
- **Oxides of sulphur**- Sulphur dioxide is produced by burning fossil fuels and it is a major pollutant released from oil refineries, etc.

In addition to the above, some industries like sugar mills, tanneries etc. release a lot of foul smelling gases. Many other atmospheric pollutants including heavy metals are common in urban atmosphere.

#### 11.4.3 Mining Areas

Suspended particulate matter is one of the major pollutants in mining areas. This is especially so in stone quarries, iron mines, etc. Other pollutants are sulphur dioxide and oxides of nitrogen.



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Atmosphere of asbestos mines contains asbestos dust which causes **asbestosis**, silica causes **silicosis**, lead, zinc and other heavy metals such as chromium, arsenic, copper and manganese, and radon gas may also accumulate in high concentrations in their respective mines. High levels of alpha and gamma radiation can also be found in and around uranium mines and uranium ore tailings.

**11.4.4 Pollution in Urban Areas**

High level of suspended particulate matter is one of the major pollutants in urban areas. This is caused by multifarious human activities such as movement of traffic, smoke from industries and diesel vehicles from automobiles gases like oxides of sulphur, oxides of nitrogen, hydrocarbons, carbon monoxide and carbon dioxide. In addition many trace metals such as iron, zinc and magnesium are found associated with suspended air particulates.



*Figure 11.5: Traffic congestion in cities during rainy season*



**INTEXT QUESTIONS 11.3**

1. From which industries are foul smelling gases released.  
\_\_\_\_\_
2. Which air pollutant is released from stone quarries and iron mines?  
\_\_\_\_\_
3. In congested townships movement of traffic on dusty roads, smoke from industries and diesel vehicles result, a pollutant gathers in air which pollutant is it?  
\_\_\_\_\_
4. List the major pollutants in agricultural areas.  
\_\_\_\_\_

## 11.5 ENVIRONMENTAL CARCINOGENS AND METHODS OF THEIR CONTROL



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Cancer is a group of related diseases that begin in cells of the body. Normally cells divide to produce more cells when body needs them for development, growth and repair of cell damage. Process of continuous division and growth of cells keeps the body healthy and normal. However, at times cells keep on dividing even when new cells are not required. These cells form a mass of tissue known as a **tumor**. The tumors can be either benign or malignant.

The **benign tumors** are not harmful. Generally they can be removed surgically and do not reappear. Further, cells from these tumors do not move to other parts of the body and rarely endanger life. On the other hand, **malignant tumors** are cancerous. Cells of these tumors are abnormal and they divide and re-divide without any control. They can invade and damage nearby tissues and organs. Cells from these tumors can break away and enter the blood stream or lymphatic system and spread from the original site to form new tumors in other organs.

Leukemia and lymphoma are cancers which are initiated in blood-forming cells. Most cancers are named after the organ concerned e.g. Cancer that begins in lungs is lung cancer and the one in skin is known as melanoma. The cancer-causing agents are known as **carcinogens**. Agents present in the environment are the **environmental carcinogens**.

### 11.5.1 Tobacco

Smoking tobacco or being regularly exposed to tobacco smoke are responsible for about 85% of all cancer deaths. Smoking may increase the chances of getting cancers of stomach, liver, prostate, colon and rectum. Use of smokeless tobacco, chewing tobacco and snuff cause cancer of mouth and throat. Exposure to environmental tobacco smoke, termed **passive smoking** also increases the risk of lung cancer for non-smokers. The risk of cancer begins to decrease soon after quitting smoking and chewing tobacco. This risk continues to decline gradually after quitting.



*Figure 11.6: People eating tobacco/ snuff and showing cancer of mouth*



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**11.5.2 Ultraviolet (UV) radiation**

UV radiation coming from sun can cause premature aging of and skin damage prolonged exposure to UV radiation may lead to skin cancer. The formation of ozone hole by compounds like chlorofluorocarbons and others, increase the incidence of UV radiation reaching the earth. This is because ozone layer acts as a shield to prevent passage of UV radiations preventing melanoma. Avoiding exposure to direct midday sun light (from 10 a.m. to 3 p.m.) is perhaps the best way of reducing the risk of skin cancer. Wearing of a broad-brimmed hat, use of UV absorbing sunglasses and clothing to cover the body adequately also offers protection against UV.

**11.5.3 Ionizing radiation**

High levels of radiation like those from radiation therapies and X-rays, and from radioactive substances can damage normal (somatic) cells and increase the risk of developing leukemia and cancers of the breast, thyroid, lung, stomach and other organs. Studies with survivors of the atomic bomb in Japan showed that ionizing radiation increases the risk of leukemia and other cancers. It is always desirable to minimize diagnostic and therapeutic exposure to ionizing radiation and protect other parts of the body during such procedures.

**11.5.4 Chemicals and other substances**

**Pesticides:** Excessive use of pesticides particularly herbicides like 2,4-dichlorophenoxyacetic acid (2,4-D) has been associated with a 200-800% increase of NHL (Non-Hodgkin’s Lymphoma) – one type of cancer in Sweden. Pesticides such as toxaphene, hexachlorocyclohexane (BHC), trichlorophenol, dieldrin, DDT are known to cause lymphatic cancer in rats and mice. The danger is increased due to the persistent nature of the residues of these pesticides in the environment resulting in chronic exposure to low levels of pesticides. The use of all these pesticides has now either been banned or restricted. Organic farming and emphasis on Integrated Pest Management (IPM) as an alternate and environment friendly method of pest control. Asbestos, nickel, cadmium, radon, vinyl chloride, benzidine and benzene are well known carcinogens. Reduction in exposure to these will reduce the incidence of various types of cancer.



*Figure 11.7: Spraying of defoliators and fall out of spray on people*



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### 11.5.5 Allergens and allergy

Substances in the environment that cause allergic reactions, are known as **allergens**. Allergens stimulate within the body an immune response which may be in the form of a reaction. An allergic person's immune system believes allergens to be damaging and so produces a special type of antibody immunoglobulin E (IgE) to attack the invading material. This leads other blood cells to release further chemicals (including histamine) which together cause the symptoms of an allergic reaction.

The most common symptoms are sneezing, runny nose, itchy eyes and ears, severe wheezing, coughing, breathlessness, sinus problems, a sore palate and nettle-like rash. Other commonly known problems could include asthma, eczema and headaches.

The most common allergens are pollen from specific trees and grasses, house dust mites, moulds, cats, dogs, insects like wasps and bees, industrial and household chemicals, medicines and foods such as milk and eggs.

Allergens contain protein which is often regarded as a constituent of the food we eat. There are some non-protein allergens including drugs like penicillin- but they need to be bound to a protein once they are in the body. The best method to combat allergy is to identify the allergen (often difficult) and avoid coming into contact with it.

#### • Blue Baby disease

Modern agriculture uses a lot of nitrogenous fertilizers and manures. This leads to increased levels of nitrates in the ground water as nitrates being soluble in water easily leach into the soil. Once the level exceeds 10 ppm it may become harmful. In areas where ground water is the only source of drinking water, this causes **methaemoglobinaemia** particularly in bottle fed infants who are very sensitive to this pollutant.

Babies drink large quantities of water; water is used to mix powdered or concentrated recipes or juices. When water containing nitrates is consumed and it reaches intestines, the intestinal bacteria convert nitrates into nitrites. The nitrite ions combine with haemoglobin to form methaemoglobin which inhibits the oxygen carrying capacity of the blood causing a kind of anaemia known as **methaemoglobinaemia**.

Methaemoglobin is formed when iron in the haemoglobin molecule is oxidized from  $\text{Fe}^{2+}$  (ferrous) to  $\text{Fe}^{3+}$  (ferric) form. Due to reduced carrying capacity for oxygen the babies gradually acquire a blue tinge and hence the name – “**Blue Baby disease**”. Symptoms are sleeping, poor feeding, decreased energy, etc. Nitrates can be removed from the water by processes like electro dialysis and reverse osmosis. Nitrites in the water can be oxidized to nitrates by introducing a strong oxidant like ozone in the water.

#### • Asthma

It is a chronic (long term) disease of the respiratory passages. It is characterized by reversible airflow obstruction (tightening of the smooth muscles around airways), inflammation (swelling) and mucous production when airways are exposed to various stimuli (triggers). Asthma has no cure but there are effective medications to control the symptoms and prevent asthma attacks. Asthma can be life threatening, requiring emergency

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room care or hospital admission. Asthma can develop at any age. What exactly causes bronchial tubes to become swollen is still not known. However, possible risk factors for developing asthma in childhood includes-

- family history of allergy and allergic disorders.
- high exposure of airborne allergy causing substances ( pet dander, house dust mites, cockroaches, moulds, etc) among susceptible children in the first year of life.
- exposure to tobacco smoke.
- frequent respiratory infections early in life.

Symptoms of asthma are breathlessness, wheezing, chest tightness or pain around the chest, persistent cough that can last several weeks.

**INTEXT QUESTIONS 11.4**

1. Name three pesticides which are known to cause lymphatic cancer in rats and mice.  
\_\_\_\_\_
2. What measures can be taken to minimize the incidence of skin cancer?  
\_\_\_\_\_
3. What are the possible programmes which can be taken up to minimize damage from pesticides?  
\_\_\_\_\_
4. What is the cause of the Blue Baby Disease?  
\_\_\_\_\_
5. Give two major symptoms of Asthma.  
\_\_\_\_\_  
\_\_\_\_\_

**11.6 HEAVY METAL TOXICITY AND METHODS OF THEIR PREVENTION**

Toxic metals are dispersed in the environment through metal smelting industrial emissions, burning of organic wastes, automobiles and coal based power generation. Heavy metals can be carried to places far away from their source of origin by winds when they are emitted in gaseous form or in form of fine particulates. Rain ultimately washes the air having metallic pollutants and brings them to the land and to water bodies.



Heavy metals may endanger public health after being incorporated in food chain. Heavy metals cannot be destroyed by biological degradation. Incidence of heavy metal accumulation in fish, oysters, mussels, sediments and other components of aquatic ecosystems have been reported from all over the world. The heavy metals often encountered in the environment include lead, mercury, arsenic, chromium. These are known to cause toxic effects in living organisms.

### 11.6.1 Lead

Lead enters the atmosphere from automobile exhaust. Tetraethyl lead (TEL) was added to petrol as an anti-knock agent for smooth running of automobile engines. TEL has now been replaced by other anti-knock compounds to prevent emission of lead by automobiles. Lead in petrol is being phased out by introduction of lead free petrol. Many industrial processes use lead and it is often released as a pollutant. Battery scrap also contain lead. It can get mixed up with water and food and create cumulative poisoning. It can cause irreversible behavioural disturbances, neurological damage and other developmental problems in young children and babies. It is a carcinogen of the lungs and kidneys.



*Fig. 11.8: Lead pollution – recovering lead from old batteries*

### 11.6.2 Mercury

In Japan, mass mercury poisoning (Minamata disease) was observed in 1960s, caused by eating fish from Minamata Bay which were contaminated with methyl mercury. Largest source of mercury pollution is through aquatic animals such as fish which accumulate mercury as methyl mercury. Mercury kills cells in the body and damages organs which come in contact with mercury and thus impairs their functioning. Inhalation of mercury vapours is more dangerous than its ingestion. Chronic exposure causes lesions in the mouth and skin and neurological problems.



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Typical symptoms of mercury poisoning are irritability, excitability, loss of memory, insomnia, tremor and gingivitis. Exposure to mercury can be prevented by taking care that mercury is not released in the environment as well as by replacing mercury by other materials. Mercury thermometers used earlier are getting replaced by mercury free thermometer.

### 11.6.3 Arsenic

Arsenic is associated with copper, iron and silver ores. Arsenic is emitted from fossil fuel burning. Liquid effluents from fertilizer plants also contain arsenic. Ground water contamination with arsenic is very common in areas where it is present. People depending on ground water containing arsenic get exposed to this pollutant. Chronic arsenic poisoning leads to loss of appetite, weight, diarrhoea, gastrointestinal disturbances and skin cancer. The water from underground sources contaminated with arsenic should not be used for drinking and cooking purposes. Surface waters are generally free from arsenic pollution and should be preferred for drinking and cooking. Alternatively the tube well/ hand pump water should be purified to remove arsenic before consumption. Techniques for removing arsenic from water are available.

#### Arsenic Pollution—A Case Study

A patient from Balia, Uttar Pradesh came to All India Institute of Medical Sciences (AIIMS), New Delhi for consultation in summer, 2004. An injury in his leg in 1996 did not heal. His two fingers got ulcers which could not be treated and had to be ultimately amputated. Subsequently he was diagnosed to be suffering from skin cancer. His blood had 34.40 ppb (ppb = arsenic which is many times higher than normal).

Out of a population of 1800 about 100 persons who were examined (age more than 35 years) were suffering from **melanosis**. Many of them were suffering from **keratosis** and some had breathing problems. Arsenic levels in hairs of two persons were 4790 and 6310 ppb (normal 80 to 250 ppb), nails 2480 ppb (normal 430-1080 ppb). Large number of people had died due to cancer. Examination of water from hand pumps, which was the main source of drinking water, showed that more than half had arsenic higher than 10 ppb in their blood (permissible limit). In 8 % cases arsenic was higher than 500 ppb.

If a person drinks water contaminated with arsenic for about 10 years, dark spot develop on the upper chest, back and arms known as **melanosis**. The next stage is **keratosis** in which palms become hard and patient may suffer from diarrhoea, stomach pain, breathing problems, etc. Later along with dark spots, develop white spots, legs become swollen and walking become difficult and painful, some wounds start bleeding, the liver and kidney suffer damage.





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### 11.6.4 Cadmium

Mining especially of zinc and metallurgical operations, electroplating industries, etc. release cadmium in the environment. It may enter the human body by inhalation or from aquatic sources including fish, etc. It may cause hypertension, liver cirrhosis, brittle bones, kidney damage and lung cancer. Itai-itai disease first reported from Japan in 1965 was attributed to cadmium contamination in water and rice caused by discharge of effluents from a zinc smelter into a river.

### 11.6.5 Other Heavy Metals

Metals such as zinc, chromium, antimony and tin enter food from cheap cooking utensils. Preserved foods stored in tin cans also cause contamination by tin. Zinc is a skin irritant and affects pulmonary system. Problems of heavy metal toxicity can be prevented by avoiding the use of utensils made from materials containing these heavy metals or use of drinking water and consuming fish having these heavy metals.



### INTEXT QUESTIONS 11.5

1. What is heavy metal toxicity?  
\_\_\_\_\_
2. State two symptoms of arsenic poisoning due to consumption of groundwater containing arsenic.  
\_\_\_\_\_
3. Mention the form in which mercury acts as a poison.  
\_\_\_\_\_
4. Which metal does battery scrap leave in the environment?  
\_\_\_\_\_

## 11.7 OCCUPATIONAL HEALTH HAZARDS

Most people spend the largest proportion of their waking hours at the work place. Many, however, often undertake agricultural or cottage industry activity within the home or in fields. In favourable circumstances work contributes to good health and economic achievements. For some, the work environment exposes them to health hazards that contribute to injuries, respiratory diseases, cancer, musculoskeletal disorders, reproductive disorders, cardiovascular diseases, mental and neurological illnesses, hearing loss, etc. Such health hazards are termed occupational health hazards, being associated with occupation.



**Notes**

**11.7.1 Heavy physical workload**

Workers who are exposed to heavy physical work loads are miners, lumberjacks, construction workers, farmers, fishermen, storage workers and healthcare personnel. Repetitive tasks and static muscular load can lead to injuries and musculoskeletal disorders and may result in short-term and permanent work disability. Unshielded machinery, unsafe structures and dangerous tools are some of the most prevalent work place hazards.



*Fig. 11.9: People cutting trees and carrying logs*

**Black lung disease**

In coal mining areas coal dust is the main air pollutant to which miners are exposed everyday. The deposits of coal dust makes miners lungs look black instead of a healthy pink and hence the name black lung disease. Black lung disease is the common name for **pneumoconiosis** (CWP) or anthracosis, a lung disease of older workers in the coal industry, caused by inhalation over many years, of small amounts of coal dust. Although people who live in cities often have some black deposits in their lungs from polluted air, coal miners have much more extensive deposits.

The particles of fine coal dust accumulate in lungs as they cannot be destroyed within the lungs or removed from them. Eventually this build-up causes thickening and scarring making the lungs less efficient in supplying oxygen to the blood.

The primary symptom of the disease is shortness of breathe which gradually gets worse as the disease progresses. In severe cases it may eventually cause heart failure. In some cases a progressive massive fibrosis develops, in which damage continues in the upper parts of the lungs even after exposure to dust has ended.

Often some patients develop emphysema (Shortness of breathe), as a complication of black lung disease. X-rays can detect black lung disease before it causes any symptoms. Patients who develop this disease at an early age, or who have progressive massive fibrosis, have a higher risk of premature death.

**Prevention-** The only way to prevent black lung disease is to avoid long-term exposure to coal dust. Coal mines may help prevent this condition by lowering coal dust level and providing protective clothes to coal miners.

### 11.7.2 Noise

Workers in mining, manufacturing and construction industries are exposed to high levels of noise which is a very important stress factor. Sound levels higher than 80 to 90 dB (dB-decibels- unit of sound) for more than eight hours are harmful to human ear. Some of the adverse effects of sound are –

- (a) **Psychological:** Noise leads to emotional disturbances such as annoyance, disturbed sleep, lack of concentration and reduced efficiency.
- (b) **Auditory effects**
  - (i) **Auditory fatigue** – Occurs when noise level is in the range of 85 to 90 dB e.g. noise of a food blender.
  - (ii) **Deafness or impaired hearing** – It may be temporary or permanent. Temporary hearing loss occurs on continuous exposure to noise as in case of telephone operators which disappears within 24 hours after a period of rest. Repeated or continuous exposure to noise more than 90 dB may result in permanent loss of hearing. This effect is more serious in case of persons having ear diseases and they should avoid noisy working environment.



*Fig. 11.10: Noise pollution*



**Notes**

**(c) Non-auditory effects**

- (i) Interference with speech and communication:** In the presence of high level of noise, one needs to strain his voice by increasing loudness to make speech intelligible e.g. in foundries, boiler cabins, etc. Street hawkers or salesmen of small stalls in busy markets need to yell continuously at the top of their voice so that they are heard. Due to this they suffer from voice disorder or even cancer of voice-box later in life.
- (ii) Annoyance:** Most people are annoyed by noise and some may become neurotic. Neurotic people lose their temper quickly and become irritable.
- (iii) Efficiency:** High level of noise at the work place reduces working efficiency. Quiet environment helps in increasing efficiency.
- (iv) General change in the body:** Exposure to noise increases blood pressure, pulse rate, breathing and sweating or headache. giddiness, nausea, fatigue, disturbs sleep, distorted colour perception and reduced night vision are general symptoms observed in victims of noise. Persons working in night shifts or those suffering from hypertension get affected by noise earlier than others.

**11.7.3 Chemicals and Biological Agents**

Workers in many industries are exposed to chemicals which are hazardous and may be even carcinogenic such as in textiles, cement and construction industries. Substances such as benzene, chromium, nitrosamines and asbestos may cause cancers of lung, bladder, skin, mesothelium, liver, etc. The only effective control strategy is primary prevention that eliminates exposure completely or that effectively isolates the worker from exposure to carcinogens. Occupational asthma is caused due to exposure to organic dusts, microorganisms, bacteria, fungi and moulds and several chemicals. Silicosis first reported from Kolar gold mines in 1947 is a common disease among miners, pottery and ceramic industry workers. Pneumoconiosis and byssinosis are common among mica and textile industry workers respectively.



**INTEXT QUESTIONS 11.6**

1. Which workers are involved with heavy physical work?  
\_\_\_\_\_
2. What kind of problem does sound level of 120 dB for a few hour may lead to?  
\_\_\_\_\_
3. State any two symptoms of long exposure to noise pollution?  
\_\_\_\_\_  
\_\_\_\_\_

**WHAT YOU HAVE LEARNT**

- Environmental pollution may adversely affect the health and well being of humans.
- Lack of clean drinking water, unhygienic conditions and pollution of the environment in villages, towns and cities are responsible for spread of diseases and large number of health problems
- Many water borne diseases such as cholera, infective hepatitis, dysentery and diarrhea, Bilharzia and malaria are transmitted by different ways. The mixing of untreated or improperly treated sewage in rivers cause extensive water pollution and related adverse health effects.
- Major air pollutants in agricultural areas are ammonia, methane and pesticides; in cottage industries and large industrial areas they are smoke, carbon dioxide and oxides of sulphur.
- In mines such as coal mines, the workers exposed to coal dust for long time suffer from Black Lung Disease for which there is no treatment except stoppage of exposure before it becomes very serious.
- At times, cells in certain parts of the body keep on dividing even though not required. These cells become cancerous and form malignant tumors. There are many environmental agents-termed carcinogens, which cause cancer. Examples are tobacco-smoking and chewing, ultraviolet and ionizing radiations and certain pesticides.
- Sneezing, runny nose, hayfever, etc are caused by exposure to some substances in the environment known as allergens, not necessarily harmful by themselves.
- Presence of high nitrate concentrations in drinking water often causes methaemoglobinaemia (Blue Baby Disease) in bottle fed infants. The nitrites produced from nitrates bind with haemoglobin to form methaemoglobin which inhibits oxygen transport in the body.
- Asthma is a disease which causes obstruction to air flow in the respiratory passages and may be an allergic disorder which may even be fatal.
- Many heavy metals such as lead, mercury, arsenic and cadmium present in the environment at higher concentrations, cause adverse reactions often leading to cancer and death.
- Workers in mines, stone quarries, some industries etc. exposed to lot of noise for varying lengths of time. Long exposure to sounds more than 85/90 dB may cause annoyance, disturbed sleep, high blood pressure and temporary to permanent loss of hearing.



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**Notes**

**Notes****TERMINAL EXERCISE**

1. What are some of the sanitary problems in villages?
2. Describe the transmission of the following diseases – Typhoid, Filaria (Elephantiasis), and Amoebic dysentery. What is the causative organism for each of these diseases?
3. Describe a disease often prevalent in coal miners working for many years. State the measures required to control it.
4. What are some of the major pollutants from a thermal power plant? What can be done to minimize these?
5. Describe the symptoms of arsenic poisoning from drinking polluted ground water. In which parts of the body can arsenic accumulation be detected?
6. Discuss the problems caused in infants by high nitrate concentration in drinking water.
7. List auditory and non-auditory problems caused by too much noise.
8. Discuss the significance of addition of tetraethyl lead to petrol. Why has been the use of leaded petrol discontinued?
9. How does a cancerous tumor differ from a non-carcinogenic tumor?
10. What are some of the major effects of smoking and chewing tobacco?

**ANSWER TO INTEXT QUESTIONS****11.1**

1. Health of a person is the result of interaction of a large number of influences upon the person.
2. To prevent for spreading many water borne diseases.
3. Slums are unplanned aggregations of hutments arranged very closely without any space for roads, parks, drains etc.
4. Lack of safe drinking water supply, improper disposal of excreta, high infant mortality (any other).

**11.2**

1. Malaria, yellow fever, encephalitis (any one)
2. Bacterial dysentery
3. *Leptospira*



**11.3**

1. Sugar mills and tanneries industries.
2. Suspended particulate matter.
3. Oxides of sulphurs, oxides of nitrogen, hydrocarbons, carbon monoxide, carbon dioxide.
4. Ammonia, pesticides smoke and water vapour.

**11.4**

1. Toxaphene/hexachlor cyclo hexane – HCH, BHC, dieldrin DDT (any three)
2. Clothing cover hands and feet, weary of broad. brimmed using of sunglasses.
3. Organic farming and Integrated Pest Management (IPM)
4. Elevated levels of nitrates in ground water.
5. Shorten of breathe, wheezing, chest lightness, pain around the chest, persistent cough that can last several weeks (any two).

**11.5**

1. Toxic metal are dispersed in the environmental through industrial effluents burning of organic wastes, transport and power generation. It may endanger public health after being incorporated in food chain.
2. Loss of appetite, loss of weight, diarrhea, gastrointestinal disturbance, skin cancer. (any two)
3. Methyl mercury.
4. Lead (Tetraethyl lead TEL)

**11.6**

1. Miners, lumberjacks, construction workers, formers, fishermen, storage workers and health care personnel.
2. Annoyance, temporary hearing loss, disturbed sleep.
3. Auditory fatigue, deadness or impaired hearing blood pressures, breathing and sweating, giddiness. (any two)