Chapter

10

Not for Breathing Not for Drinking

One day Akshay and his father Satyam went to Bazaar on Motor bike. A traffic constable stopped them and asked his father to show his driving license and other documents. He showed the driving license and other documents. Then the constable asked Satyam to show the certificate of pollution check. He did not have one. The traffic constable fined him and asked him to go to any certified pollution check centre for pollution under control certificate or the pollution check certificate.

Satyam went to the pollution check up centre. There the emissions from his motor bike were checked and a pollution under control certificate was issued with details of amount of pollutants in the emissions.

Fig-1 : Pollution checkup

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In the evening when Satyam returned home, Akshay wanted to see the pollution under control certificate. You can also see that certificate. Here it is.

Fig-2 : Pollution certificate

Observe this certificate and try to find out answers for the following questions:

1. Which department issues the pollution under control certificate?
2. For how much time is it valid?
3. For which type of vehicle has it been issued?
4. What is emission test? What components are tested in the pollution check up center?

5. What will happen if Carbon monoxide (CO) and Hydrocarbons (HC) readings are higher than the permissible limits?

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Discuss these issues in the class room.

- In your opinion, what is the need of "Pollution Under Control Certificate?"

With a rapid increase in the number of vehicles, the problem of automobile pollution has assumed greater significance. Since the emission of smoke from motor vehicles is a major source of air pollution, specific standards for the permissible limits for such emission have been prescribed in the Motor Vehicles Act 1988 and Central Motor Vehicles Rules 1989.

All vehicles which are in operation for more than a year should undergo emission tests every six months to obtain the certificate of pollution under control.

The word pollution might not be new for us. Our elders talk about the blue sky, clean water and fresh air that was available in their times.

Scientists regularly report on the falling quality of the environment. We ourselves feel the impact of the air and water pollution in our lives. Number of people are suffering from diseases of the respiratory system, for example lung cancer, Asthma are steadily rising.

If we do not control pollution clean air and water may no longer be available! You have learnt about the importance of air and water in earlier classes.

Now, we will study about the harmful changes taking place in our surroundings and their effects on our lives.

What is Environmental Pollution ?

The environment is made up of living and non-living components which are inter dependent. When everything is working the way it should be, all the components of the environment will be functional, healthy and balanced in the nature.

- What will happen if harmful organisms or substances enter your body? How do you feel?

In the same way if something harmful is introduced into the environment and it gets disrupted it can cause a chain of problems affecting all the resources, plant and animals life. These changes really hurt the health and well being of living organisms. Pollution therefore can be described as the disturbance of environmental balance caused by human activities. It can also be caused by chemical substances, biological species or by dangerous radiations including sound and heat.

Pollution is the addition to the environment (air, water, land) of harmful substances or energy in quantities that are harmful to life.

What is Air pollution?

The composition of air in the atmosphere comprises four major gases namely nitrogen, oxygen, argon and carbon dioxide. Other substances are present in a very little amount and hence, they are collectively known as trace components. Let us observe the composition of air in

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the atmosphere shown in the in the graph and table below:

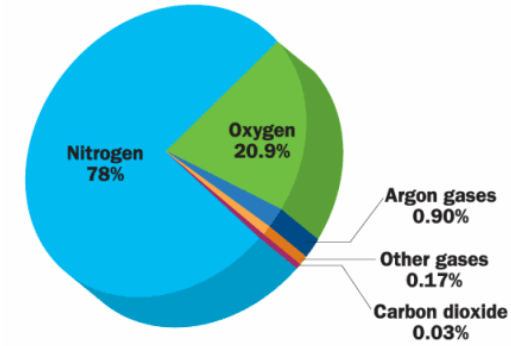

Table - 1

Componet	Symbol	Volume	
Nitroten	N_2	78%	Total Volume of gases = 100%
Oxygen	O_2	20.947%	
Argon	Ar	0.923%	
Carbon Dioxide	CO_2	0.03%	
Other Traces	-	0.1%	
Water Vapour	H_2O	1%	

The atmosphere contains about 21% of Oxygen which is an essential element for survival of all living organisms.

It is also important for the combustion, we read about this in the chapter 'Combustion, flame and fuels'. Carbon dioxide which is 0.03% is essential for the process of photosynthesis in plants.

All the other components have their own importance and all are in a naturally balanced state. When this composition or the state of balance in air is disturbed either by any natural phenomenon or by human activities, it is then called "Air-Pollution" and the substances responsible for disturbing this naturally occurring balance in air are said to be "Air Pollutants".

There are some air pollutants that enter the air by natural disasters, such as volcanic eruptions, forest fires, dust and sand storms.

Activity-1

- Collect information from your school Library for the following natural disasters in the world.
  - ❖ Volcanic eruptions
  - ❖ Forest fires
  - ❖ Sand storms
  - ❖ Tsunamis

These natural disasters lead to air pollution. But the majority of pollutants are added to the air because of human activities.

Think and discuss

- If a person burns tyres or dried leaves at a particular place, where does the smoke and ash go?

Airborne pollutants make it tough to breathe and can even cause diseases like cancer. One problem is the way winds criss-cross the globe, picking up pollutants and carrying them all over the world. This is how areas far away from where the actual pollution is created can become affected, too. Air pollution is not just a local concern.

Activity-2

Oil Paper Experiment

Take three square pieces of white paper of 5 X 5cm size dipped in oil. Hang these oil dipped papers at three different

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locations, say, your backyard, your school, near a park, or a parking lot, etc. Let the papers be there for 30 minutes. Later observe and compare all three papers.

- What did you find on those papers dipped in oil?
- Is there any difference in appearance among the papers?
- Try to find out the reason for this difference?
- What do you conclude from observations?

Air Pollutants

As we discussed above, air pollutants arise from both man made and natural processes. These pollutants are of two types : Primary and Secondary pollutants.

Pollutants are also defined as primary pollutants resulting from combustion of fuels and industrial operations and secondary pollutants, those which are produced due to reaction of primary pollutants in the atmosphere.

Natural Activities:

- Forest fires release carbon particles (ash) into the air and pollute the air.

Fig-3 : Volcanic eruption

- Volcanic eruption releases various gases and ash into the atmosphere.
- Decay of organic matter releases Ammonia gas into the air.
- Decay of organic matter lying under water releases Methane gas.
- The pollen grains released by plants remain suspended in the air and pollute it.

Human activities

❖ **Burning fuels**

Burning fuels pollute the air producing pollutants like carbon monoxide, sulphur dioxide, smoke, soot and ash.

Fig-4 : Burning fuel

- Name the fuels burnt in day to day activities in both rural and urban areas.

❖ **Vehicles:** Exhaust gases emitted by motor vehicles pollute air by producing the harmful pollutants like sulphur dioxide, nitrogen dioxide, carbon monoxide, unburnt hydrocarbons, lead compounds and soot.

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❖ **Industries:** Various industries like granite, lime, cement etc., pollute air by releasing pollutants such as sulphur dioxide, nitrous oxide, chlorine, fly ash , dust, asbestos dust etc.

- Name the factories located nearby. How do they affect the air and water there?

❖ **Nuclear power plants:** The two problems of nuclear power are radioactive waste and the possibility of disasters like **Chernobyl.** Nuclear waste is dangerous because it can cause cancer and other health problems. The radioactive wastes possess radio activity for at least one million years. The other problems are melt downs. Melt downs are provoked by too much heat in the power plant. During a melt down the power plant makes more Radioactive pollution.

Chernobyl Disaster

The biggest meltdown of Nuclear power reactor in the world was in Chernobyl, Soviet Union in 1986. After the melt down of chernobyl, there was an explosion and formation of radioactive cloud. The radiation released during this disaster directly killed hundreds of people and affected around 5 million more. About 125,000km^2 of fields were unusable because of the radioactive clouds. The forest area was damaged by the radioactive clouds.

Do you know?

Cement industries are in Mella cheruvu, Matampally of Nalgonda district and Tandoor, Karankot of Vikarabad district. Granite industries are in the most polluted areas because granite powder, cement dust, limestone dust is released into the air causing pollution. Thermal power plants in Ramagundam of Peddapalli, Palvancha of Khammam

districts are releasing the pollutants like fly ash, Sulphur dioxide and radioactive substances causing the air, water and land pollution. People are suffering from lung cancer and skin allergies due to the pollutionThe people living near the granite factory have faced several health problems like respiratory bronchitis and asthma. Thermal power plants pollute air by emitting sulphur dioxide, radio-active substances and fly ash.

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❖ **Power Generation Plants**

There are a number of power generation plants in our country. Some produce power by using water (Hydro electric power plants), by using coal and gas (Thermal power plants), by using Radioactive elements like Uranium (Nuclear power plants). Electricity is also produced from the air and tides of the oceans. Ash dust and SO_2 from the thermal power plants are polluting the environment.

Activity-3

Go to your school library and collect information to make a list of these power generation plants and where they are located in our country.

Collect information on power generation plants in our country and write the information in a tabular form as shown below.

Table - 2

S. No.	Name of the power plant	Location in India
1.	Mundra thermal power station	

Discuss about the pollutants released and the pollution caused by the power plant listed above.

❖ **Fertilizers and Pesticides:** Use of fertilizers and pesticides in agriculture pollute not only air but also land and water. You already learnt these issues in the chapter 'Production of food from plants'. Discuss its effects in the class room.

Fig-5 : Spraying Pesticides

❖ **Deforestation:** It is the destruction of forests and woods. It has resulted in the reduction of indigenous forests. Forests now cover only 19% of the earth's land surface. Plants use carbon dioxide for the process of photosynthesis. Due to lack of forests the consentration of carbon dioxide is increasing day by day resulting in global warming. Discuss about the adverse effects of Global warming?

Fig-6 : Deforestation

❖ **Chloro Flouro Carbons (CFC):** CFCs are used in refrigerators, Air conditioners and aerosol sprays. Use of CFCs pollutes air by depleting the ozone layer as a result of which, harmful ultraviolet rays reach the earth. What ill effects do we suffer from exposure to UV rays?

❖ **Mining:** Mining of coal and stone releases coal dust and stone dust that cause air pollution.

Let us read about pollutants and their sources with the help of Table-3.

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Common pollutants and their sources

Table - 3

Pollutants	Sources
Suspended Particulate Matter (SPM)	Automobile, power plants, boilers, Industries requiring crushing and grinding such as quarry, cement.
Chlorine (Cl_2)	Sea-salt production, de-chlorination, biomass burning, pulp & paper mills.
Fluorides	Fertilizer, Aluminium refining
Sulphur dioxide (SO_2)	Power plants, boilers, sulphuric acid manufacture, ore refining, petroleum refining.
Lead (Pb)	Ore refining, battery manufacturing, automobiles.
Oxides of nitrogen (NO, NO_2)	Automobiles, power plants, nitric acid manufacture, also a secondary pollutant
Peroxy Acetyl Nitrate, (PAN)	Secondary pollutant
Formaldehyde (HCHO)	Secondary pollutant
Ozone (O_3)	Secondary pollutant
Carbon monoxide (CO)	Automobiles, incomplete fuel combustion.
Hydrogen sulphide(H_2S)	Pulp and paper, petroleum refining.
Hydrocarbons	Automobiles, petroleum refining
Ammonia (NH_3)	Fertilizer plants, decomposition of dead plants and animals.

From the table, identify the gaseous pollutants and particulate pollutants and then make a list of both, in your textbook.

Let us understand the effects of air pollution not only in human beings but also to the historical monuments. For this we need to study about Taj Mahal. Do you know currently the cars and buses are not allowed to drive to the Taj Mahal but the battery-run buses or horse-drawn carriages are allowed to reach the monument. The Archeological department of India declared that $2^1/_2$km around Taj Mahal is 'No drive zone'.

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Case Study: The Taj Mahal

The Taj Mahal, one of the seven wonders of the world is located in Agra. It is made of white marbles. The effect of pollutants on it has become a matter

of concern for archeologists and environmentalists.

Motor vehicles and the industries located in and around Agra for rubber processing, Chemicals, Iron foundries, Mathura oil refinery have been responsible for producing pollutants like SO_2, NO_2, smoke, dust, soot etc.

These gases react with the rain to form acid rain. Acid rains corrode the marble of the Taj Mahal. Suspended Particulate Matter (SPM), such as the soot particles emitted by Mathura oil refinery has turned the marble from white to yellow.

Taking this in to account, the Supreme Court of India has suggested several steps to save the Taj. These are:

- Switch over to cleaner fuels like CNG and LPG.
- Use unleaded petrol in vicinity of Taj Mahal.
- Shift polluting industries to the outside of Agra city.

Bhopal Gas Tragedy Unforgettable Human Sin

Industries are the symbols of development. But other side of the coin is lack of safety measures and irresponsibility of emitting pollutants. On second December 1984 about 3000 human beings died, about 5000 were paralyzed and thousands of cattle, birds, dogs and cats died in just one night at Bhopal. This mass death was due to the leakage of Methyle Isocyanate (MIC) into the air from an insecticide factory managed by Union Carbide. Thousands of lives helplessly, crushed under the cruel foot of inhuman activity. This is the unforgettable industrial tragedy towards air pollution.

What are the effects of air pollution?

Air pollution continues to evoke a great deal of interest worldwide due to its negative impacts on human health and welfare. It causes certain diseases including shortness of breath, sore throat, chest pain, nausea, asthma, bronchitis and lung cancer. Extreme effects of air pollution include high blood pressure and cardiovascular problems.

The World Health Organization states that 2.4 million people die each year from causes directly attributable to air pollution (WHO, 2007).

In addition to its negative health impacts, air pollution is known to cause injuries to animals, forests and vegetation, and aquatic ecosystems. Its impacts on

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metals, structures, leather, rubber, and fabrics include cracks, soil deterioration, soil erosion etc.

Some of the negative effects caused by these pollutants are discussed below.

Various harmful effects of pollutants

- **Particulate Matter:** Dust and smoke spoil our cloths, reduce visibility and affect the buildings; dust and smoke get deposited on the leaves of the plants. Thus affects the rate of photosynthesis and transpiration. They also cause Bronchitis, Asthma in human beings. Particles of lead oxide present in automobile exhaust can cause Anaemia, Brain damage and even death. Particles of mercury cause Minimata disease which affect the nervous system and can cause death.
- **Hydrogen Sulphide:** Tarnishes silver objects and blackens lead paints and painting. It has a smell like Rotten Eggs. It causes head ache in humans when inhaled in a large quantity.
- **Carbon monoxide :** It is a poisonous gas. If it combines with haemoglobin in our blood, it forms a stable compound called carboxy haemoglobin. Due to the formation of this compound haemoglobin is unable to carry oxygen to various parts of our body. This leads to respiratory problems. It causes suffocation and may cause even death.
- Air pollution causes ozone depletion, Green House effect, Global warming and Acid rain. We will read these effects in higher classes.

Think and Discuss

When we go on a busy road in the evening where a dense smoke is spread in the surroundings. We get cough and feel uneasy even when we close the nose with napkins.

- Why do we feel such discomfort? Think about it.
- If these symptoms continue, what happens?

Air pollution is like a slow poison. The effects of air pollution are not seen immediately. But over a long period of time, the pollutants present in air damage our health and property.

Activity-4

Field visit

Visit nearby factory, industry (boiled rice mill, Brick making kiln, oil mill, food processing mill, etc.) present in your area and observe,

- Are they polluting air and water? If yes, How?
- Is there any green belt around the factory? Name the trees they are growing.
- What precautions dothey take to prevent pollution?

What can we do to reduce air pollution?

Air pollution cannot be totally eliminated, it can however be controlled. Some of the methods for controlling air pollutions are:

- Tall chimneys should be installed in

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all factories to reduce air pollution at the ground level.

- The 'Fuel burning equipment' which burns the fuel completely should be used in homes and industries.
- Install electrostatic precipitators in the chimneys of industries.
- Reduce vehicular emissions by using non polluting fuels like CNG.
- Use LPG for domestic use.
- Improve the quality of fuel in automobiles and use catalytic converters in them.
- Make use of Renewable alternative source of energy like Solar Energy, Wind Energy and Hydro Energy.

❖ All motor vehicles should be maintained properly so that they comply with pollution norms.

❖ Use unleaded petrol

❖ Plant and grow more and more trees in your surroundings.

❖ We should protect plants and trees .Do you know about **Vanmahotsav, Haritha Haram** and **Swatch Patashala** where lakhs of Saplings are planted in July every year? But how many saplings are surviving? Discuss, think about the reasons and solutions.

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Water Pollution

Air is the important resource for human survival. In the same way water plays a vital role in our lives. The history of human civilization explains that they develop on the banks of rivers, because water is a main resource for human development. After industrial revolution water resources are being polluted. Water pollution is another hazard caused by greedy human being activities.

Let us read the following news paper clipping understand it and answer the following questions :

❖ What do you understand after reading the news paper clipping?

❖ What are the issues discussed in this news paper clipping?

❖ What are its causes and effects?

❖ How does the problem arise?

❖ Are you also facing this type of

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భూగర్భం విషతుల్యం..

రసాయన పరిశ్రమల కాలుష్యంతో భూగర్భం విషతుల్యమైంది. భూగర్భజలాలు పూర్తిగా కలుషితమయ్యాయి. నీటిలో టీడీఎస్ (టోటల్ డిసాల్వ్‌డ్ సాలిడ్స్) ఉండాల్సిన అధిక మోతాదు 500. అయితే చౌటుప్పల్, భూదాన్ పోచంపల్లి, చిట్యాల మండలాల్లో 10వేల వరకు ఉన్నట్టు పరీక్షల్లో తేలింది. భూదాన్ పోచంపల్లి మండలం దోతిగూడెం గ్రామ శివారులో ఓ బోరుబావిలో నుంచి వచ్చే నీళ్లలో 19,520 దాకా టీడీఎస్ ఉంది. చౌటుప్పల్ మండలం కొయ్యలగూడెంలో 9,143, మందోళ్లగూడెంలో 3,400, చౌటుప్పల్‌లో 3,531, ఆరెగూడెంలో 7,085, గుండ్రాంపల్లిలో 2,009టీడీఎస్ ఉన్నట్టు పరీక్షల్లో తేలింది. ఈ నీళ్లు తాగడానికి కాదు, వ్యవసాయానికి కూడా పనికిరావని నిపుణులు తేల్చి చెప్పారు. అయినా రైతులు సాగు చేసిన పంటలు ఎక్కడికక్కడ చనిపోతున్నాయి.

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problems in your area? Can you explain reasons behind?

In the previous class we have already discussed water, its usage and sewage water treatment. Let us see class VII Science Textbook. Just go through the chapter 'Water too little to waste'. Now we will discuss water pollution, it causes and effects.

A Case Study of Patancheru

Patancheru is a suburban mandal headquarters in Sangareddy district, located about 25km from Hyderabad. It is a major industrial hub of Telangana State. It is one of the most polluted areas in India where the villages in the sorrounding areas of 14 km radius were badly affected by the diseases like cancer, respiratory diseases and heart diseases, because of poisining (pollution) of air, water and land."

The presence of pharmaceutical and chemical industries, pesticide units, steel rolling industries, distilleries are releasing the dangerous gaseous pollutants like Chlorine, Hydrogen sulphide which enter the Atmosphere. Most of the agricultural lands became barren. The lives of people there depend on agriculture and animal husbandry. They became helpless. Most of the people converted themselves as workers in the factories.

By observing all situations, for the sake of people and environment, the Supreme Court of India has released Interim orders as follows:

1. Stoppage of effluent flowing into air & water bodies immediately.
2. Provide drinking water to the affected villages.
3. Rectification of CETP (Common Effluent Treatment Plant).
4. Medical care to pollution victims.
5. Sustained continuous vigilance in discharge of effluents.
6. Discharge of treated effluents in to sewage line.

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Lab Activity

Aim: Observation of pollutants in local available water samples.

Material: Glass tumblers, water samples from tap, pond, river, well, lake, Red and Blue litmus papers, soap.

Procedure: Collect water samples from a tap, pond, river, well and lake. Pour each into separate glass containers. Compare these for smell, color, pH and hardness.

- pH of water samples can be determined by using litmus paper . If blue litmus paper turns to the red color, that water sample is acidic in nature and if red litmus turns to blue, water sample is basic in nature.
- Hardness of water can be determined using a soap. If water produces lesser foam, it is referred to as hard water. If water produces more foam, it is called soft water.

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Observations : Record your observations in the following table.

Table - 4

Water Sample	Smell	color	pH		Hardness of water	
			Acidic	Basic	More	less
Tap water						
Pond water						
River water						
Well water						
Lake water						

Think and Discuss

- Do you find any relation between pH and hardness of water?
- Which water sample is colorless?
- Which water sample is suitable for drinking and why?
- Do you find any change in colour and smell of water in some water samples? What are your reasons?
- Which water sample of your collection is basic in nature?
- Are there any visible pollutants in the water sample?

Precautions: While conducting the experiment you need to follow the following precautions. Observe carefully change in colour of litmus paper. Wash your hands each time. Don't taste any water sample. (If you have followed any more precautions add to the list.)

- Discuss the findings drawn from the contents of the table and record.

What do we mean by water pollution?

Water is a unique substance, because it can naturally renew and cleanse itself, by allowing pollutants to settle down (through the process of sedimentation) or break down, or by diluting the pollutants to a point where they are not in harmful concentrations. However, this natural process takes time, and is difficult when excessive quantities of harmful contaminants are added to the water. And humans are using more and more materials that are polluting the water. Thus, the contamination of water with unwanted and harmful substances such as sewage, toxic chemicals, industrial wastes etc. is casuing water pollution and the substances that pollute water are called water pollutants.

Normal water is colorless without any smell or any unwanted substances. Thus, water suitable for drinking is called potable water.

Most of the water resources like rivers, tanks and canals are being polluted by adding various pollutants from factories and by adding garbage. River with great historical background and good resource

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for drinking and agriculture are now becoming water stagnated dumping garbage. Let us read about the sad story of river Musi.

Sad Story of River Moosi

As Hyderabad has grown in size and is emerging as a global mega city, its growing water requirements have been met by under taking long distance water projects over the years. These projects are dependent on Musi River. Thousands of people depend on it for their daily needs and livelihood. The Musi has been polluted for many years. The people living near the Musi River throw large quantities of garbage, untreated sewage, industrial waste, dead bodies, polythene bags, hot water and statues of deities and many other materials directly in to the river .

The 'Musi reservoir action plan project' was undertaken to reduce the pollution level in the river. Pollution control activities include under the project are.

- Solid waste management.
- Installation of sewage treatment plant.
- Provision of low cost sanitary facilities.
- Development of River front.
- Efforts to develop public awareness

Although we still have a long way to cover to make Musi River absolutely free from pollution, this programme helped in reducing Musi river pollution to a significant extent. Industrial wastes are casuing water pollution in many rivers, ponds of our state.

Acitivity-5

Visit your nearby pond/ lake or river and find out the material being discharged into it. Prepare a Biography on it.

Where is all of this pollution coming from?

There are two main sources of water pollution; definite and non-definite sources.

Fig-7 : Polluted water stream

Definite source pollution is due to discharges from a single source, such as an industrial site. It includes factories, wastewater treatment facilities, septic systems, and other sources that are clearly discharging pollutants into water sources. Non definite-source pollution involves many small sources that combine to cause significant pollution. For instance, the movement of rain or irrigation water over land picks up pollutants such as fertilizers, herbicides and insecticides carries them into rivers, lakes, reservoirs, coastal waters, or groundwater. Non-definite sources are more difficult to identify, as they cannot be traced back to a particular location. Landfills can also be a non-definite source of pollution, if substances leach from the landfill into water supplies.

Water pollutants thus can be divided into the following categories:

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Biodegradable waste: This consists mainly of human and animal waste. The biodegradable waste enters the water supply and thus pollute the water. The waste provides an energy source (organic carbon) for bacteria. Organic carbon is converted to carbon dioxide and water, which can cause atmospheric pollution and acid rain; this form of pollution is far more widespread and problematic than other forms of pollutants as a large supply of organic matter in the water provides an opportunity for oxygen-consuming (aerobic) bacteria to multiply quickly, consume all available oxygen, and kill all aquatic life.

- Ask your teacher about aerobic bacteria and write a note on it with few examples.

***Plants nutrients*:** Phosphates and nitrates, chemical fertilizers from agriculture run-off due to rain and industrial waste enter into water through sewage and pollute the water. It helps algae to bloom, weeds to grow and bacteria to spread. As a result water turn green and cloudy and smell bad. Decomposing plants use up the oxygen in water, disrupting aquatic life, reducing biodiversity and even killing aquatic life. Thus, this enrichment of water by nutrients leading to excessive plant growth and depletion of oxygen is known as '**Eutrophication**' This affects aquatic life badly.

- Do you know oil slick on sea water? In what way it is dangerous to aquatic life?

Heat: It can be a source of pollution in water. As the water temperature increases, the amount of dissolved oxygen decreases. Thermal pollution can be natural, in case of hot springs and shallow ponds during summer. The discharge of water that has been used to cool power plants or other industrial equipment is another reason.

Fig-8 : Chemical pollutants

Fish and plants require certain temperatures and oxygen levels to survive. So thermal pollution often reduces the aquatic life diversity in the water.

***Sediment*:** It is one of the most common sources of water pollution. Sediment consists of mineral or organic solid matter that is washed from land into water sources. Sediment pollution is difficult to identify, because it comes from non-definite sources such as constructional, agricultural, logging, flooding, and city runoff. Sediment can cause large problems, as it can clog municipal water systems, smoother aquatic life, and cause water to become increasingly turbid. Turbid water can cause thermal pollution, because it absorbs more solar radiation.

***Hazardous and toxic chemicals*:** These are usually human-made materials that are not used or disposed of properly. The industrial waste contains a large number of harmful chemicals like acids,

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alkali and metals such as arsenic, lead, mercury and cadmium leading to toxicity. Domestic and personal use of chemicals also significantly contribute to chemical pollution. Household cleaners, dyes, paints and solvents are also toxic, and can accumulate when poured down drains or flushed down the toilet. In fact, one drop of used motor oil can pollute 25 litres of water! And, people who use pesticides in their gardens and lawns tend to use ten times more pesticide per acre than a farmer would!

***Pharmaceuticals*:** Pharmaceuticals and personal care products including medications, lotions and soap, are being found in increasing concentrations in lakes and rivers causing water pollution.

Hazardous substances like fluorine mixed in ground water cause dangerous diseases called fluorosis. See annexure for more details.

Prevention And Controlling of Water Pollution

Water pollution can be prevented or minimized by adopting following measures.

- Toxic industrial wastes should be treated chemically to neutralize the harmful substances present in it before discharging into rivers and lakes.
- The sewage should not be dumped in to the rivers directly. It should first be treated at the sewage treatment plant to remove the organic matter from it in the form of manure.
- The use of excessive fertilizers and pesticides should be avoided.
- The use of synthetic detergent should be minimized or biodegradable detergents should be used.
- Dead bodies of human beings and animals should not be thrown in to rivers.
- The excreta and other garbage should be treated in a biogas plant to get fuel as well as manure.
- The water of rivers, streams, ponds and lakes should be purified or cleaned. This can be done both by the industries and the govt. For example Ganga action plan launched by the Indian Government.
- Trees and shrubs should be planted along the banks of the rivers.
- There should be general awareness among the masses regarding the harmful effects of water pollution and the ways of prevention. Waste paper, plastics, waste food materials and rotten food and vegetables should not be thrown in to open drains.
- Follow 4R's to control pollution (Reduce, Reuse, Recycle and Recover).
- Reduce the usage of the materials to the extent possible. Go for the alternate energy resources that can replenish themselves without affecting our environment.
- Once the materials are used for their primary purpose, reuse them for some secondary purpose. e.g if you have got your print outs on a plain white paper, you can use the other side of the paper once the project is over and the papers are no longer needed for printing. In this

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manner you can save considerable amount of trees to be cut down to meet the demand of papers.

- Recycling is the next stage of reuse.

Most of the materials can be recycled for use and recycled again and again till their properties are useful and are not degraded to an extent that can prevent their effective use.

Natural resources are the divine gift for us by nature. We can use these resources in a meaningful way which will help us. If we destroy these resources human life will become an unsolvable puzzle. We should keep these resources clean and healthy not only for us but also for future generations.

Key words

Polllution, air pollution, polluants, volcanic eruption, thermal power plants, Chloro Fluro Carbons (CFCs), water pollution, potable water, toxic industrial wastes, fertilizers & pesticides, eutrophication, biodegradation, reduce, reuse, recycle suspended particulate matter (spm), biomagnification, carboxy Haemoglobin.

What we have learnt

- Pollution is any undesirable change in physical, chemical or biological characteristics of air, water or soil.
- Air pollution is the contamination of Environment by impurities which may have harmful impacts on the living organisms and the non- living components of the environment.
- Pollutants are the substances which contaminate the environment. Main pollutants are suspended particulate matter, Carbon monoxide, excess carbon dioxide, oxides of sulfur and nitrogen, CFCs and heavy metals.
- Causes of Air pollution: Burning of fuels, vehicles, industries, thermal power plants, Nuclear power plants, Fertilizers and pesticides, deforestation, CFCs and mining.
- Air pollution causes various diseases like respiratory diseases, cancer, etc.
- The contamination of water with unwanted and harmful substances such as sewage, toxic chemicals, and industrial waste is known as water pollution.
- Industrial wastes, sewage waste, fertilizers, and pesticides are releasing pollutants that cause water pollution.
- Water borne diseases like typhoid, cholera, dysentery, jaundice, and diarrhea are some of the effects of water pollution.
- Environmental pollution can be controlled taking preventive measures using 4R's.

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Improve your learning

9DFT3R

1. How does air pollution lead to water pollution? (AS 1)
2. What steps can be taken up to control air pollution and water pollution? (AS 1)
3. Why does the increased level of nutrients in the water affect the survival of aquatic organisms? (AS 1)
4. Road side plants cannot grow properly - Find your own reasons and explain with your argument. (AS 1)
5. Sudheer is a traffic constable. What do you think about his health. Give some suggestions to protect his health during duty period. (AS 2)
6. Write a short note on the effects of water pollution in your village suggest precautions (AS 4)
7. Visit a pollution check centre. Observe the process of conducting a pollution check and record your findings. You may consider the following areas for your record: Average number of vehicles checked in a certain time period, Time taken to check each vehicle, Pollutants checked for, The process of testing, Permissible limits of emission of various pollutants, Measures taken if the emitted gases are above the permissible limits. (AS 4)
8. Organize a field visit to a pond / lake / river present in or near to your village with the help of your teachers.
   Observations followed by discussion could focus on... The history of the pond or lake or river, Water resources available other than that river/ pond/ or lake, Cultural traditions, Pollution concerns, Source of pollution, Effects of pollution on the people living by the river side as well as those living far away. (AS 4)
9. What is air pollution? Make a flowchart to describe its causes and effects. (AS 5)
10. Clear and transparent water is always suitable for drinking. Comment. (AS 6)
11. If our monument like Taj Mahal is effected by air pollution, what is your advice to protect it? (AS 6)
12. Reshma going to talk about controlling measures of soil pollution. Prepare a write up for her. (AS 6)
13. To conduct a quiz program on air and water pollution, prepare five thought provoking questions. (AS 6)
14. 'Use Bicycle – Avoid motor bikes and cars.This slogan is prepared by Sravani. Prepare some more slogans on pollution. (AS 7)
15. If you are a general manager of a chemical industry what precautions would you take to control air and water pollution? (AS 7)
16. How to minimize the usage of paper in daily life? (AS 7)

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ANNEXURE

What is fluorosis?

A boy suffering from Fluorosis

Look at this picture. Do you know how and why is he looking so? Yes, he is suffering from a dangerous disease called fluorosis, which is caused by intake of fluorinated food and water. Most of the places in Nalgonda, Medak, Khammam and Mahaboobnagar districts of our state are affected by fluorosis.

Fluorosis is a disease caused by excessive ingestion of fluoride through water and food. The upper limit of optimum fluoride level in drinking water for a tropical country like India is 0.5 PPM (parts per million) or 0.5 Mg/l. It is the total daily intake through water and food that determines the development of fluorosis.

Endemic skeletal fluorosis was identified in Yellareddyguda, Batlapally, Yedavalli villages of Nalgonda. Yellareddyguda, Naibai and Yedavalli villages of Nalgonda district are known to have a very high (2.0 to 7.5ppm) incidence of fluorosis. Fluoride in take came from food.

Fluorosis diseases are of four forms dental, genu valgum, skeletal and neurological. Low endemicity is those villages, which have only cases of dental fluorosis. In addition if there are cases of Genu valgum, Skeletal and Crippling forms, they should be considered as the villages with high endemicity . Low endemicity cases only need calcium, magnesium and vitamin supplementation to children and adolescents to prevent Genu valgum deformities occurring.

All children living in affected areas of fluorosis and consuming water containing more than 1.5 PPM of fluoride would develop dental fluorosis. Permanent teeth are affected which become rough, opaque and chalky white. Pitting and chipping of the teeth are also same. Brown, black or yellow pigmentation is deposited on the teeth.

Genu valgum is the deformities of limb bones, which are notably seen in weight bearing lower limbs in children in endemic areas of fluorosis. These occur only in poorly nourished children whose diet is low in calcium intake.

Bony changes occur due to excessive ingestion of fluoride over a long period of time. This leads to crippling in people in endemic regions beyond the age of 30 years. In these places river water is good for drinking than well or borewell water.

These deformities are to be prevented by providing adequate diet containing optimum amounts of calcium in growing children. Milk is a good source of calcium but it is expensive. There are many vegetables which are rich source of calcium, magnesium and vitamin C Eg: Finger millets, Agathi, Amaranth, Colacasia leaves (Chamakura), Thotakura, Ragi, Curry leaves, Poppy seed, Jaggery, Gingelly seeds, Jowar, Cummin, Amla, Green chilly, etc. School children are provided milk and leafy vegetables in their midday meal. The people living in flourine rich areas need not use flouride toothpaste.

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