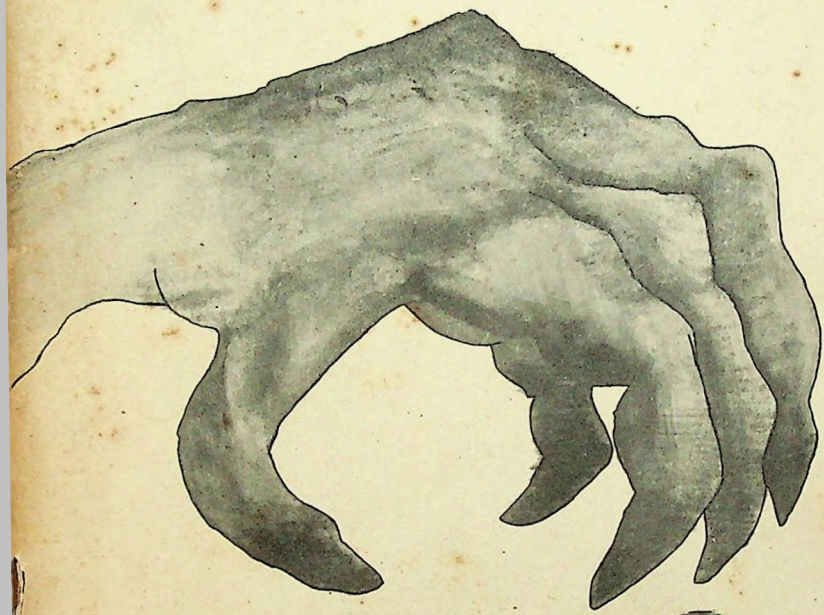
POLLUTION

N. Seshagiri



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N. Seshagiri

Illustrations: NBT Workshop, New Delhi, 1982

NATIONAL BOOK TRUST, INDIA

1984 (*Saka* 1906)
Reprint 1988 (*Saka* 1910)

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Coordination with illustrations

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Published by the Director, National Book Trust, India,
A-5 Green Park, New Delhi-110016

Machine Age or Pollution Age?

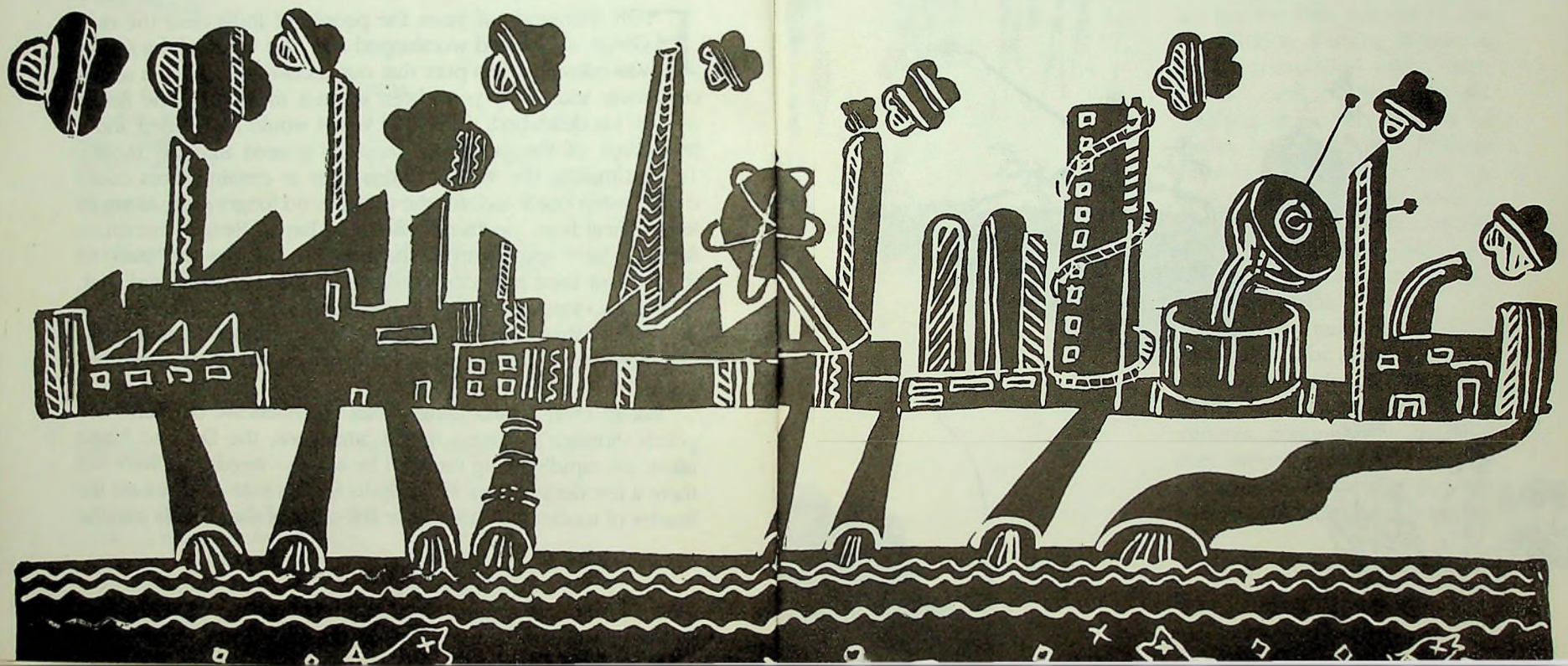
FOR thousands of years the people of India held the river Ganga sacred and worshipped her. The water of the Ganga was considered so pure that our ancestors stored it in sealed containers and, many years later, when a member of the family was on his death-bed, the sealed vessel would be opened and a few drops of the preserved *Gangajal* poured into his mouth. Today drinking the waters of this river at certain places could easily hasten one's end, for the Ganga is no longer pure. Along its long course from the Himalayas to the Bay of Bengal, numerous factories have sprung up in the past few decades and many of them throw their poisonous waste products into the sacred river. This is also true of the Kaveri, the sacred river of the south. One by one our rivers are becoming dumping grounds for poisonous chemicals from factories, agricultural wastes, insecticides and even acids.

But in even greater danger than our rivers are our lakes and ponds. Srinagar's famous tourist attractions, the Dal and Nagin lakes, are rapidly being throttled by weeds—weeds that were not there a few decades ago. The culprits for this state of affairs are the hordes of tourists who throw the left-overs of their meals into the

lakes' waters. Fed on this sumptuous fare, weeds have multiplied abundantly. Worse still is the case of the Loktak lake in Manipur. This lake is choked with vegetation so dense that one can walk over it. Many others like the Chilka lake in Orissa too are threatened.

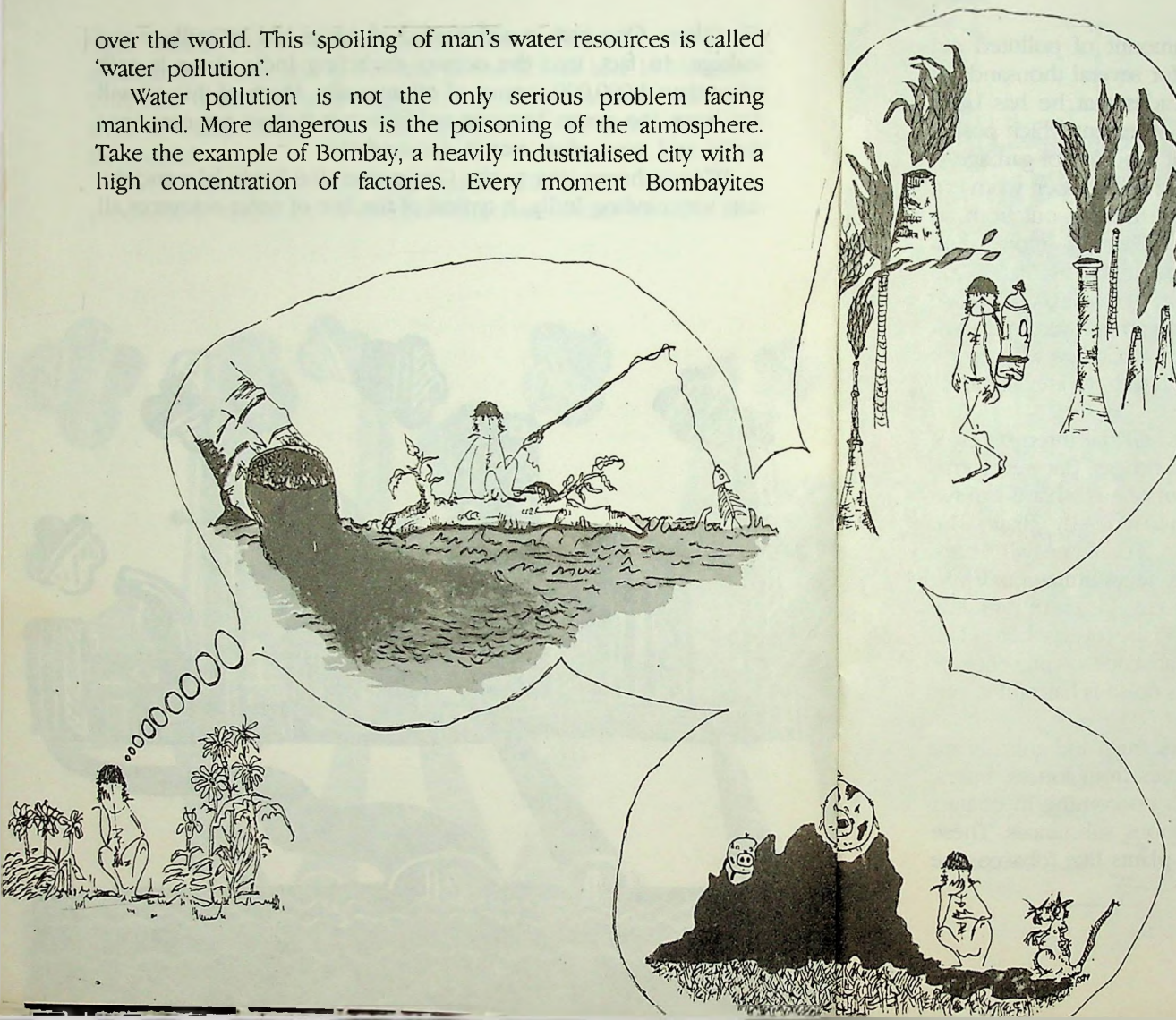
Even oceans have not been spared. More than half the oil produced in the world is transported across oceans by ships and oil-tankers. One part in a thousand of this is lost by spillage and leakage. In fact, into the oceans encircling India alone is spilt more than 1,000,000 tonnes of oil annually. Much of this oil will not leave the ocean because unlike water it does not evaporate easily and year after year it accumulates.

What is happening to the Ganga river, the Nagin lake and the seas surrounding India, is typical of the fate of water resources all



over the world. This 'spoiling' of man's water resources is called 'water pollution'.

Water pollution is not the only serious problem facing mankind. More dangerous is the poisoning of the atmosphere. Take the example of Bombay, a heavily industrialised city with a high concentration of factories. Every moment Bombayites breathe air containing so many poisonous chemicals that ten per cent more of them suffer from asthma, bronchitis, coughs, colds and headaches than citizens of almost any other city or town in India. Air pollution is the greatest threat to our health in the future. Factories with chimneys throwing out smoke into the air are not the only sources of this air pollution; a major offender is the automobile—cars, vans, lorries and buses. Smoke belching from the exhausts of lorries and buses is a familiar sight, but did you know that the vehicles of just five cities—Bombay, Calcutta, Delhi, Madras and Bangalore—spew daily into the air we breathe more than 1,000,000 kilogrammes of smoke? How much is 1,000,000 kilogrammes of smoke? To give you a rough idea, if 100 diesel lorries throw out smoke for five minutes continuously, together they would produce only one kilogramme of smoke! You can well imagine the damage to your

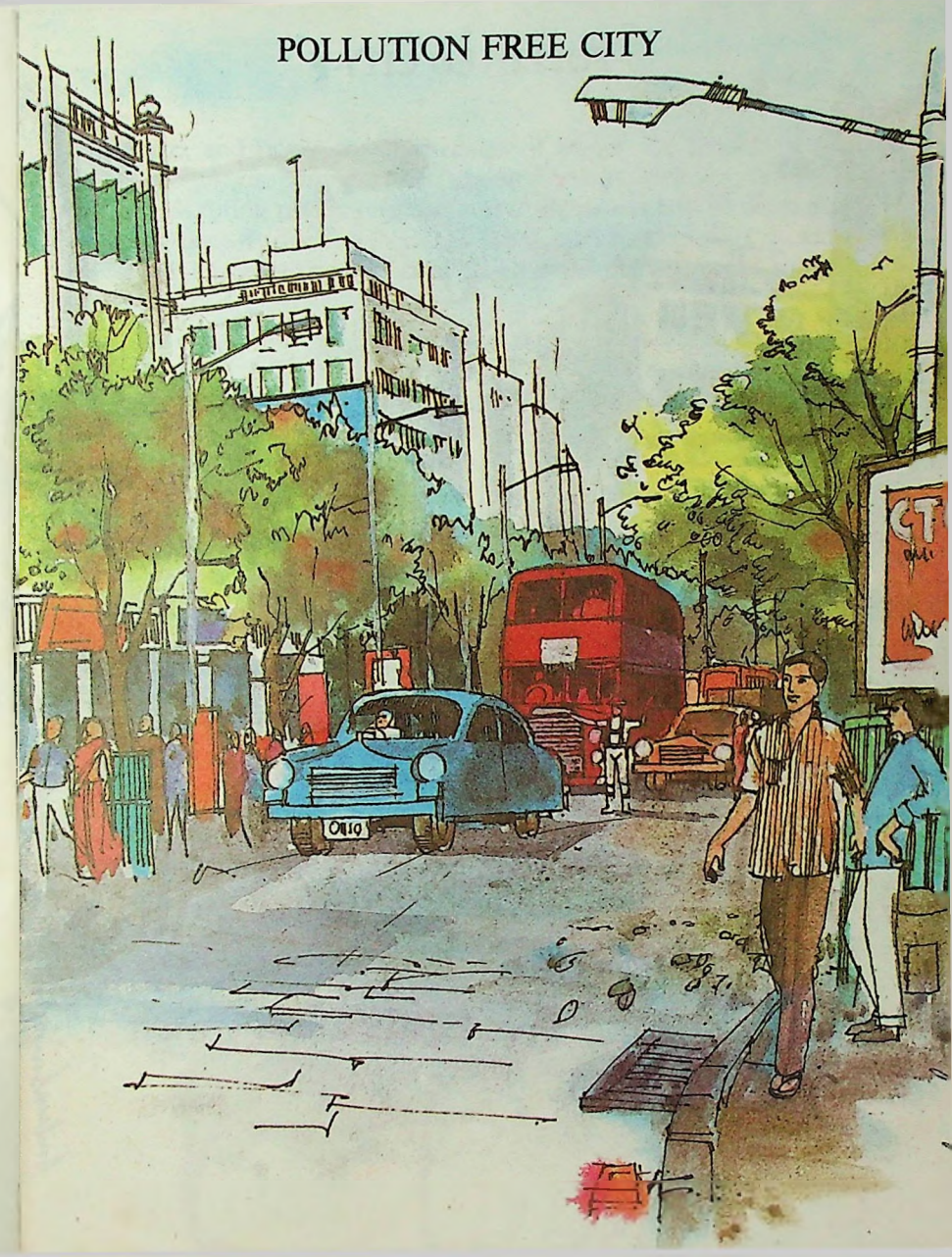


health caused by 1,000,000 times that amount of polluted air!

Civilized man has been in existence for several thousands of years. Yet, it is only in the last few decades that he has been throwing out garbage and solid wastes to an extent which pose a threat to his well-being. Daily, at least half a bucket of garbage—left-overs of cut vegetables, empty polythene bags, paper, worn-out clothes and a variety of other rubbish—are thrown out from an average Indian household. In India, there are more than 100,000,000 families. They account for as much as 50,000,000 buckets of solid waste every day. In a year, nearly 20,000,000,000 buckets of these wastes find their way to garbage yards. If such garbage yards are not provided, people throw garbage wherever it is convenient for them. Just think how much filth we are spreading around us.

We thus see that pollution has invaded all the three states of matter we are familiar with—solid, liquid and gas. But new forms of pollution are appearing. The most recent one is what is known as 'noise pollution'. If you live in a city, go to a nearby village. The surroundings may appear to be too quiet. For those who have lived in cities all their life, this silence may seem unnatural. If you live in a village, take a trip to a crowded city. You will probably feel strange because of the continuous noise everywhere. The difference, in both cases, is due to the absence or presence of noise pollution. A high level of continuous noise is harmful to our nervous system.

Not only human beings but even plants, trees and animals are affected by pollution. Petrol or diesel fumes from lorries, buses, and cars contain certain chemicals which on coming in contact with sunlight, are transformed into poisonous substances. These poisonous substances can affect sensitive plants like tobacco, the

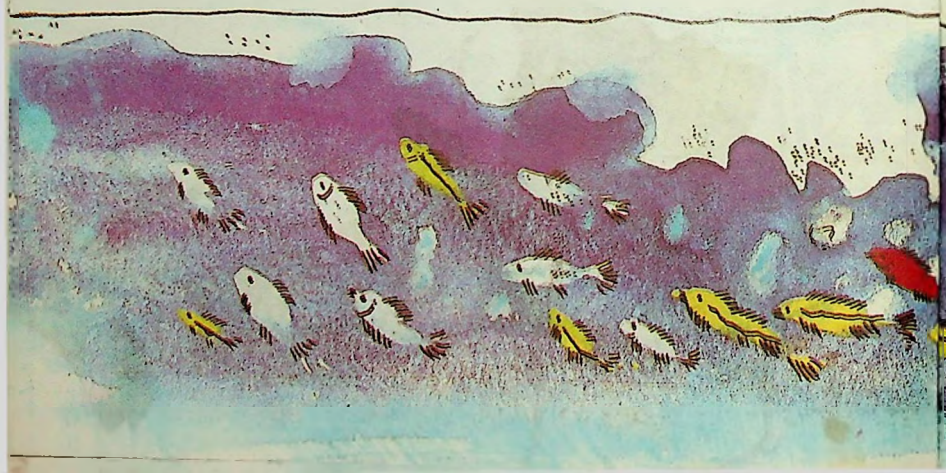


tomato, and potato, some varieties of beans and spinach, some cereal crops and certain flowers. Smoke from factories manufacturing plastic produce chemicals which injure cotton and rose plants. Factories processing metal ore produce silver dioxide which has destroyed tens of thousands of hectares of timber plantations.

It is true that we have entered the glorious age of machines. But unless we show more respect for the environment around us, this may also turn into the dark age of pollution.

The Growing Ditch

WE take water for granted. We can get as much of it as we want by turning on a tap, drawing it from a well or taking it from a river. But water is precious. History has been shaped by water. No civilization has prospered without ample water around it. The Indus Valley Civilization arose on the banks of the river Indus. Indian kingdoms flourished along the courses of the rivers Ganga and Kaveri. In ancient Mesopotamia, people waged war for control of the life-giving rivers Tigris and Euphrates. When water ran out or became unusable, civilizations died.



Are we taking enough care of this precious commodity? We waste water and we pollute it. The case of Malappadu, a village in Guntur district of Andhra Pradesh illustrates this. This village is situated on the banks of the river-stream Chappadibagu. Less than 1,000 people known as Lambadas live here with their cattle. The cattle drink water from this stream. Around 1977, this peaceful village became the victim of a strange disease. The cattle developed diarrhoea and within a few days suffered paralytic strokes. This was followed by more complications and ultimately death. Scientists who investigated the disease found that the stream was polluted with lead-based chemicals and the cattle had died of lead poisoning. The Government of Andhra Pradesh immediately ordered a nearby factory to stop poisoning the stream.

The tragedy at Malappadu is a typical example of the poisoning of rivers and lakes by irresponsible factory management. Industrial waste products containing dangerous chemicals which may kill cattle and even human beings are thrown into nearby lakes, streams and rivers.

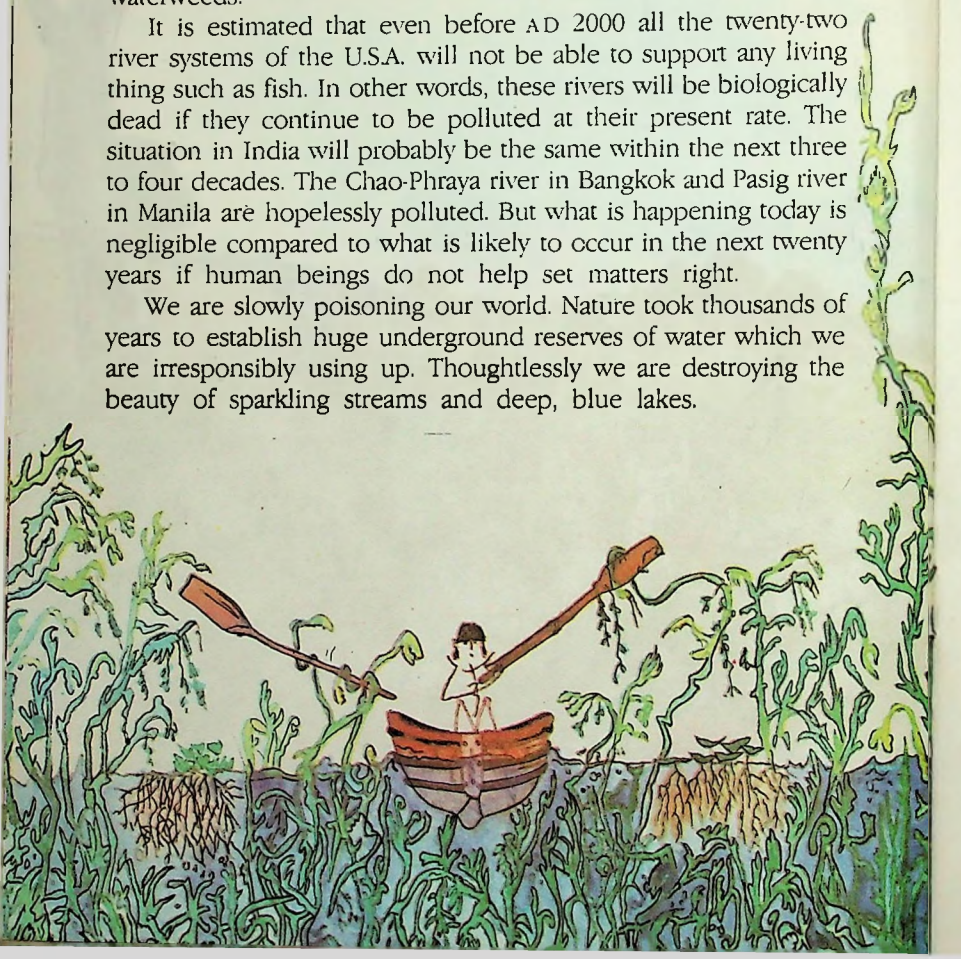
In Varanasi, a large oil refinery dumps into the sacred river Ganga several tonnes of waste products. In addition, more than

10,000 litres of sewage are poured into the river. If the Ganga receives such treatment, you can imagine the fate of rivers considered less sacred!

We have already noted that the Dal and Nagin lakes in Srinagar, which were once ideal for boating, are now smothered with waterweeds.

It is estimated that even before AD 2000 all the twenty-two river systems of the U.S.A. will not be able to support any living thing such as fish. In other words, these rivers will be biologically dead if they continue to be polluted at their present rate. The situation in India will probably be the same within the next three to four decades. The Chao-Phraya river in Bangkok and Pasig river in Manila are hopelessly polluted. But what is happening today is negligible compared to what is likely to occur in the next twenty years if human beings do not help set matters right.

We are slowly poisoning our world. Nature took thousands of years to establish huge underground reserves of water which we are irresponsibly using up. Thoughtlessly we are destroying the beauty of sparkling streams and deep, blue lakes.



The Oceanic Blunder

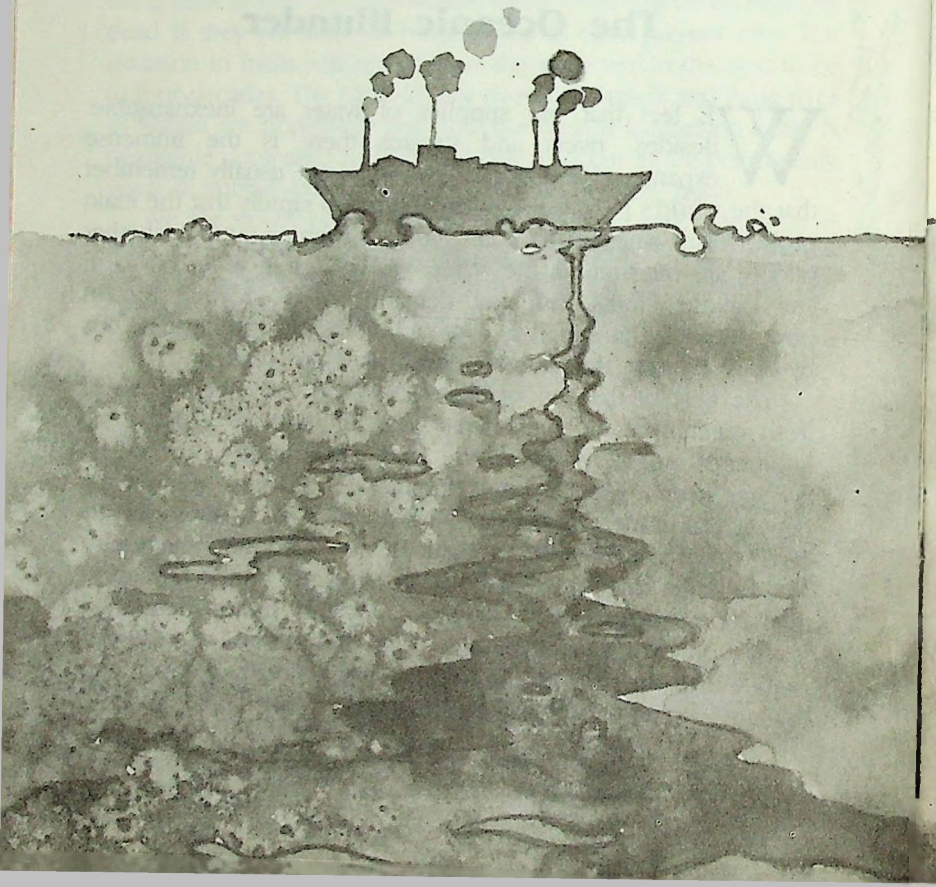
WE feel that our supplies of water are inexhaustible. Besides rivers and streams there is the immense expanse of the ocean. But we don't usually remember that the world's population is expanding so rapidly that the main problem isn't whether the water supply is running out but whether people are out-running the water supply. Usable water on earth has definite limits. But the demands of a growing human population on this supply is without bounds. We can illustrate this by showing that the 'infinite ocean' is quite limited.

The heat of the sun evaporates 340,000 cubic kilometres of fresh water from the ocean every year. In addition, 60,000 cubic kilometres are derived from the land. Thus, at any time on an average nearly 400,000 cubic kilometres of water are moving between the earth and the sky. What goes up has to subsequently come down as rain, snow and hail. This is called the 'water cycle'.

This large mass of water, however, gives per human being less than 200 cubic metres of water per day. And, human beings are not the only consumers of water. Animals, birds and even insects require a daily share of it. Water is used directly for drinking, washing, etc. and also indirectly, for agriculture and industry. If we

do not plan the use of water properly we will soon be in trouble.

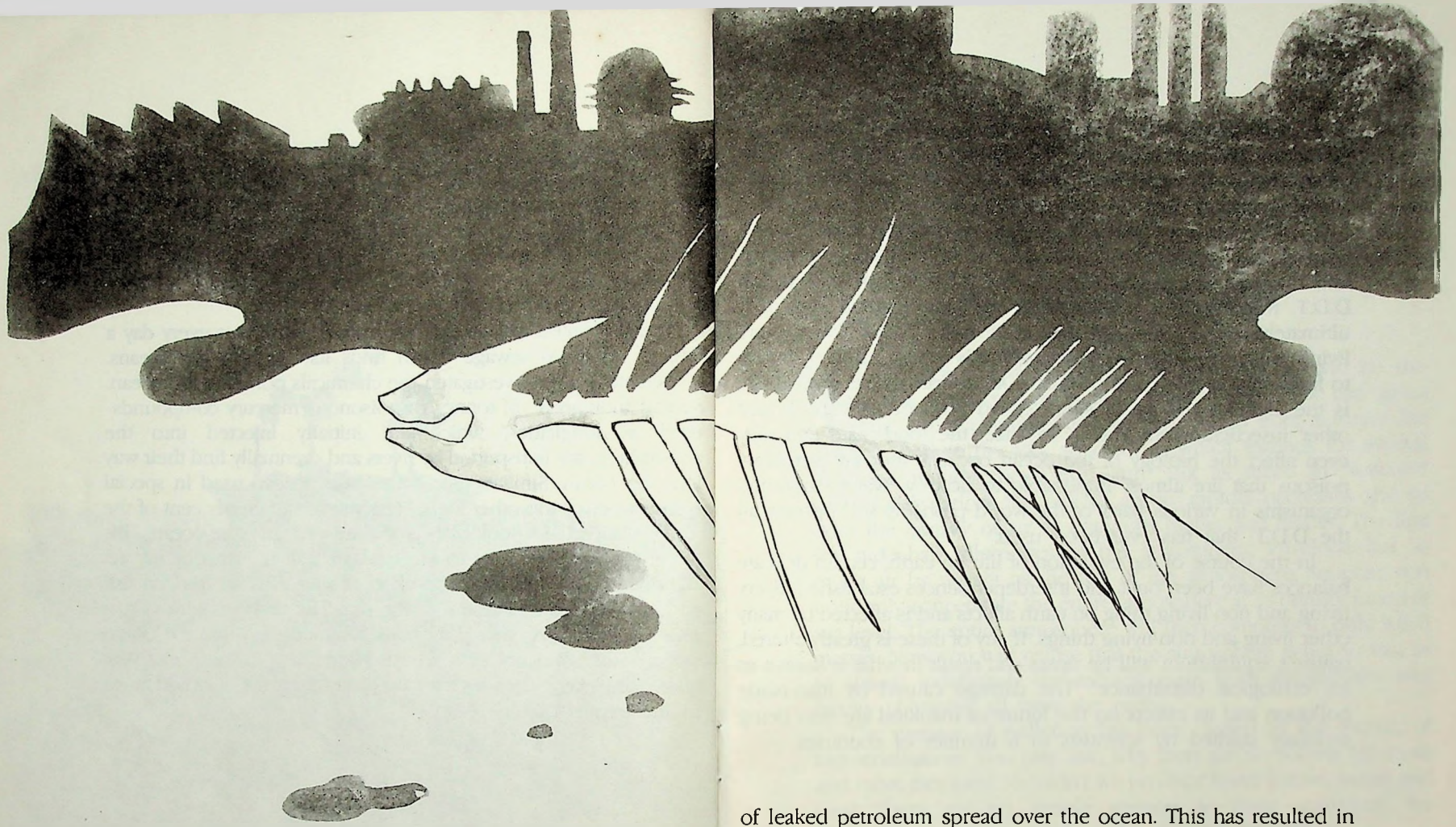
You may think that the area under the oceans is very large and can take all the rubbish we may throw into it. Though the earth has about 12,000,000,000 cubic kilometres of water, the effects of polluting the oceans is becoming evident.



The oceans are receiving the discharge of waste products in increasing amount and variety. On an average an Indian every year uses more than one tonne of fuel and two tonnes of mineral, food and forest products. Nearly all of these materials, employed in social, agricultural and industrial activities, are dispersed above the surface of the earth in different forms and ultimately a major portion gets dumped into the ocean.

It is estimated that an average Indian contributes every day a litre of untreated sewage which finds its way into the oceans.

Scientists have investigated the chemicals polluting the ocean. Several thousands of tonnes of poisonous mercury compounds used as fungicides, which are initially injected into the atmosphere, are transported by rivers and eventually find their way into the ocean. Similar, too, is the case of lead used in special types of petrol and other fuels. Nearly seventy-five per cent of the lead produced in automobiles is washed away into the ocean. This is equivalent in quantity to the total amount dumped by nature. We do not yet fully know the effect of mercury and lead on fish and other living organisms of the sea. The real problem is that mercury, lead and other poisonous substances go into the ocean but are not taken out of it. These accumulate in the ocean year after year. Several decades later, they may affect the flora and fauna in the depths of the ocean.



An important source of ocean pollution is petroleum. In the time it takes you to read this page more than 2,000 litres of oil will have been spilled into the ocean. Every year a few million tonnes

of leaked petroleum spread over the ocean. This has resulted in the smothering of beaches in black slime, ruining the tourist trade, killing thousands of sea birds and destroying fish harvests.

It is estimated that 1,000,000 tonnes of chemicals similar to petroleum products are produced within the ocean. Thus, we are contributing as much petroleum to the ocean as nature itself.

An important item of man-made pollution in the oceans is D.D.T. Chemicals are increasingly used in controlling insects and other pests that affect crops. When D.D.T. is sprayed on plants, it kills the pests and saves the crops. But the plant does not absorb D.D.T. Most of it is washed away by rain. A good part of it ultimately finds its way into the ocean. In the ocean almost every living thing eats other living things and is in turn eaten by others to form what is called a 'food-chain'. At the base of this food-chain, is the algae, a very small single-celled form of life. D.D.T. and other insecticides are known to affect the food-chain and may even affect the biology of the ocean because they are persistent poisons that are almost impossible to destroy. Water, soils and organisms in various parts of the world probably still possess all the D.D.T. that has ever been used.

In the course of the evolution of life on earth, certain delicate balances have been built and interdependences established. Every living and non-living thing on earth affects and is affected by many other living and non-living things. If any of these is greatly altered, nature's equilibrium will be upset and result in what is known as an 'ecological disturbance'. The damage caused by man-made pollution and its effects on the future of mankind are now being seriously studied by scientists in a number of countries.

The Hidden Menace

IN the first chapter we said that air pollution will be the greatest threat to our health in the future. How can gases from factory chimneys and exhaust fumes from automobiles possibly pollute the vast atmosphere which extends for several thousand metres above the earth? But as stated in Newton's Law of Gravitation, the pull of gravity rapidly decreases and so does the density of air as one goes higher and higher. The first five-and-a-half kilometres of the atmospheric envelope has as much air by weight as the rest of the atmosphere. Suppose you uniformly concentrate the entire atmosphere at its density found at sea-level. The entire atmosphere will then compress to only 9,000 metres. Now you will realise that the atmosphere is not so vast as to absorb indefinitely the exhaust gases from automobiles and factory chimneys all over the earth.

The menace of pollution has been caused by the growth of industrialisation. You may ask, why then are we setting up more and more factories? Shouldn't we produce fewer lorries, buses and cars? There are no simple answers to these questions, for industrialisation has also brought us great benefits.

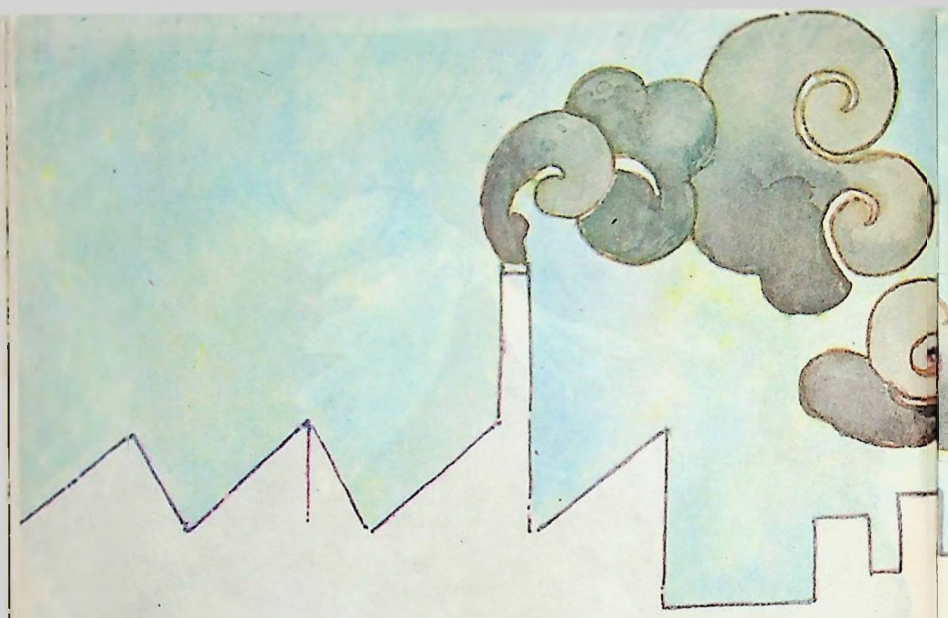
With the development of science, our medical knowledge has

grown considerably. This has led to fewer people dying than those being born, which in turn has led to an increase in population. With more people, the necessities of life—food, clothes and even drinking water—are required in greater quantities. As long as the population keeps swelling we can live comfortably only by more industrialisation.

We have to set up more and more factories to produce the clothes we wear. We have to use more insecticides and fertilizers and make a larger number of tractors to cultivate the land more extensively and increase our food production. If more factories are built, the demand for energy to run them also increases. For more energy to be produced, we have to burn more coal and oil.

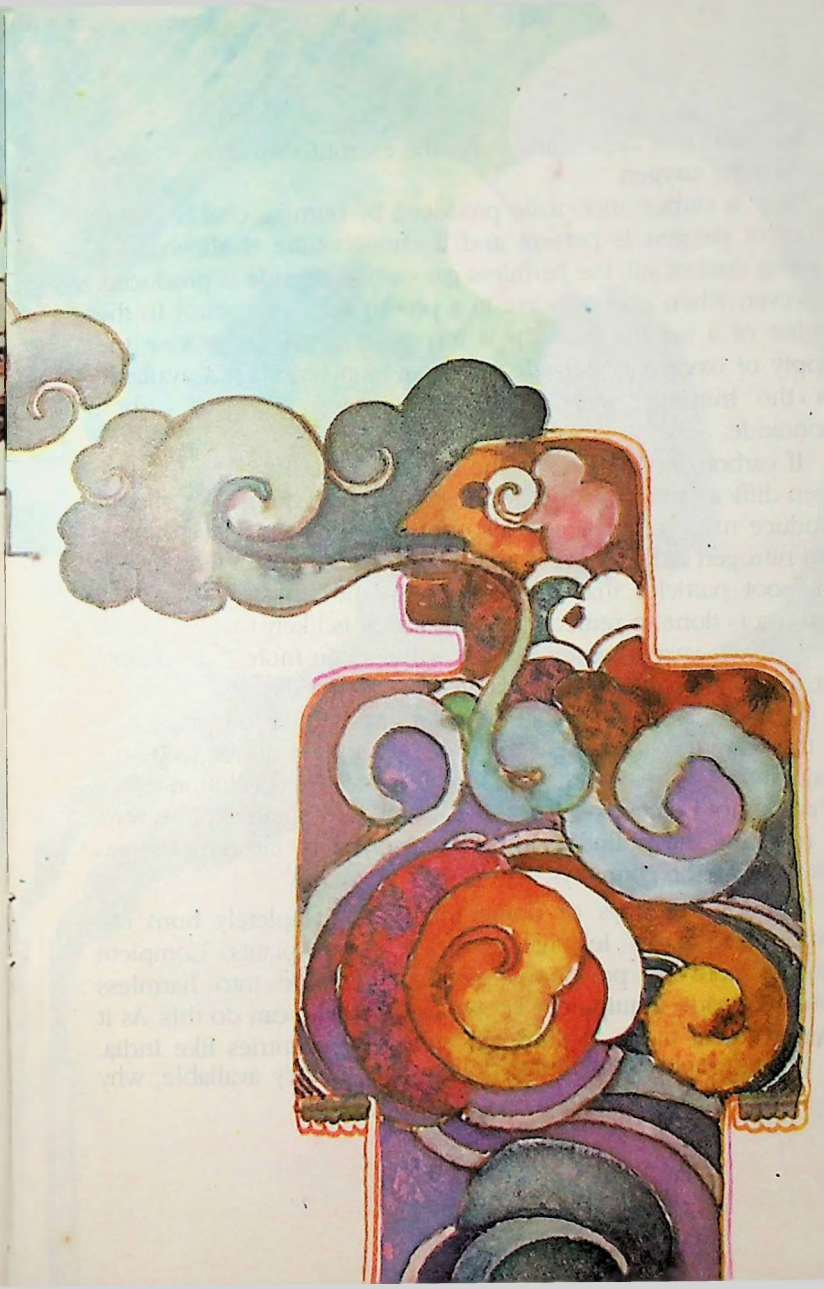
You may have heard coal being called the 'Black Diamond' and oil 'Liquid Gold'. These descriptions are certainly appropriate as both are prized fuels in producing the energy that is required to run factories. Unfortunately, these valuable fuels are among the worst offenders in the pollution of air. Over the past fifty years nearly half the known reserves of coal and oil in the world have been burnt. Industrialisation is taking place so rapidly that it won't be surprising if the remaining half is exhausted within the next twenty-five years. You can imagine how much more pollution will be caused! Thus the hazards to health caused by this hidden menace may defeat the ultimate aim of industrialisation which is a more comfortable life.

Have you ever visited a power generating station using coal or oil? If you haven't try to visit the one at Indraprastha Estate in Delhi, that at Trombay in Bombay or some other. You will see large clouds of smoke bellowing out of the chimneys. The power generating station at Indraprastha Estate emits every month about thirty tonnes of polluting gas per square kilometre around it. Do



you know what will happen if you are caught in a full blast of this smoke for a long time? You may get a headache, feel dizzy, your eyes will start flickering, your ears will ring, you may vomit, have difficulty in breathing or perhaps even become unconscious. This is because the smoke produced is the dangerous gas carbon monoxide.

Why does carbon monoxide affect us this way? Our blood has a substance called 'haemoglobin' which reacts with oxygen. Unfortunately, it can also react with carbon monoxide. Even more unfortunately carbon monoxide reacts with haemoglobin 200 times faster than oxygen. Let us suppose we breathe polluted air which has only one part of carbon monoxide and 100 parts of oxygen. Even then, our blood will haye twice as much carbon monoxide as oxygen. This reduces the ability of our blood to take oxygen and we could get any of the symptoms, from headaches to



unconsciousness, depending upon the extent to which our blood can absorb oxygen

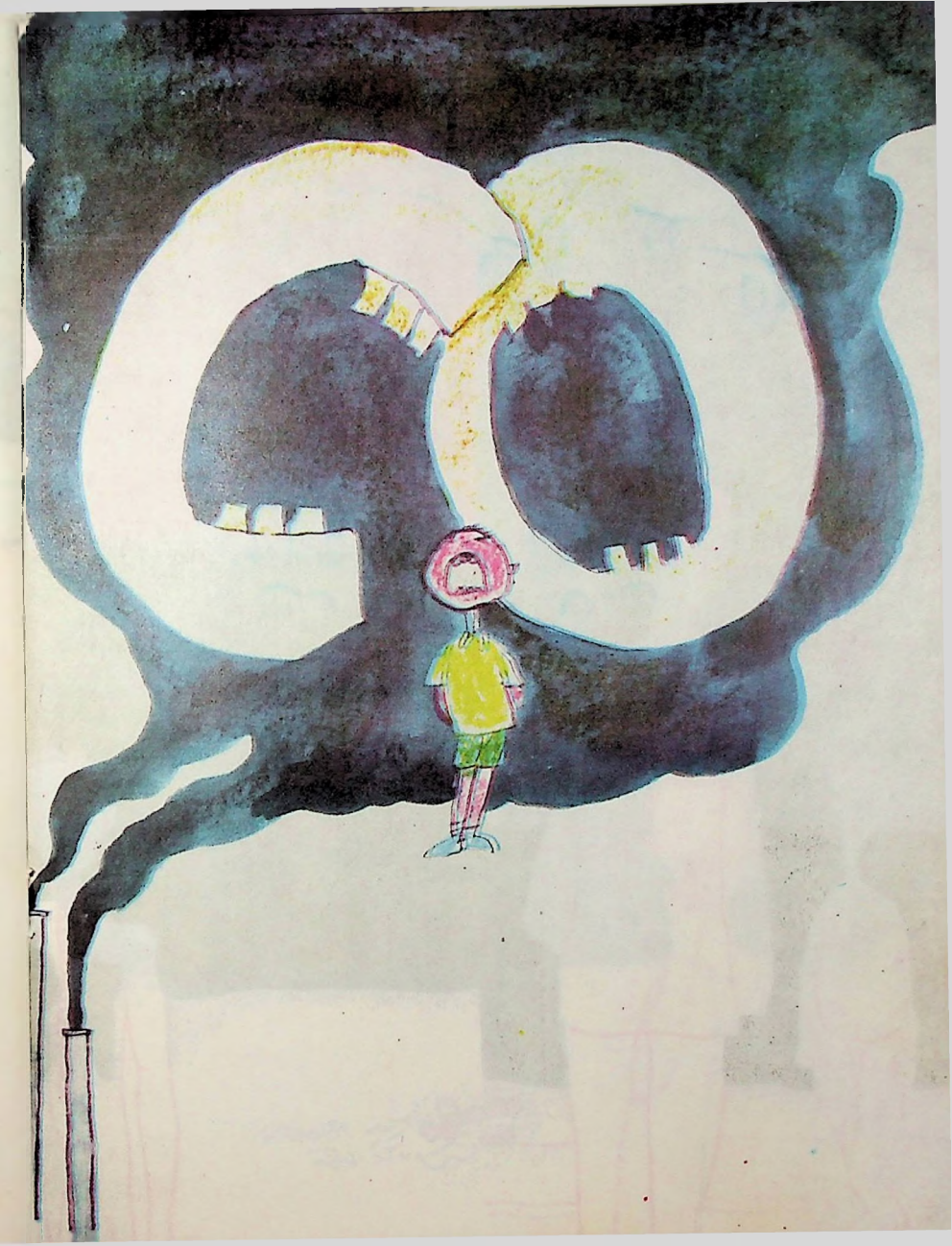
How is carbon monoxide produced by burning coal or oil? If sufficient oxygen is present and if enough time is allowed for burning coal or oil, the harmless gas carbon dioxide is produced. However, when coal is burnt in a power station or petrol in the engine of a car the burning is incomplete. This is because the supply of oxygen is not adequate—enough time is not available for the burning. Such incomplete burning produces carbon monoxide.

If carbon monoxide was the only menace, it would not have been difficult to bring it below the danger mark but power stations produce many other chemicals too. Half of all the silver dioxide and nitrogen oxide come from them as do more than a quarter of the soot particles that float around in the atmosphere. And if nothing is done to remedy the situation, it is likely that within the next fifteen years the atmosphere will contain more than double the present level of these dangerous chemicals.

India has enormous coal deposits, specially of low grade coal in the eastern region. Inevitably, coal will thus continue to be the major fuel in power generation even if it causes pollution. Since what cannot be cured has to be endured, we should explore ways of reducing the pollution in the atmosphere by cleaning the gas flowing out of chimneys.

One of the ways of doing this is to completely burn the combustible gases left half-burnt by power plants. Complete burning converts poisonous carbon monoxide into harmless carbon dioxide. Equipment known as 'The Flair' can do this. As it does not cost much, it is ideally suited for countries like India.

If equipment for fighting pollution is already available, why



hasn't every factory installed it? The reason is rather complicated. A true life story will explain this. In 1971, a new steel mill was commissioned in America in Texas. The mill was near a major wildlife sanctuary. In their desire to preserve the wildlife near them the management invested about ten per cent of their total cost on pollution-control equipment. The result was a pollution-free factory. Everyone was happy including the managers of the wildlife sanctuary. But within a few years, the steel mill was in difficulties. As a lot of money had been spent to set up a pollution-free factory, the price of the steel produced turned out to cost more. Their competitors, who did not invest in pollution-control equipment, could sell their product cheaper!

The only answer is that the evil of pollution has to be fought collectively and regulations passed obliging all factories to invest in pollution-control measures.

The other alternative is to discourage the use of coal and oil as far as is practicable and encourage other methods of power generation. Atomic power stations are a good alternative. This power from the atom is the same power which is used destructively in atomic bombs. It should really be used to generate energy. But it should be used carefully. Safe methods of throwing away radio-active wastes are essential. Another attractive alternative is to tap energy from sunshine. It is free from pollution. However, solar power stations are still in the experimental stage and it may be many years before we adopt this method on a large scale for the generation of pollution-free energy. A great deal of research is being done all over the world to develop devices that harness natural forces such as the wind, tides and ocean waves for power.

Behind the Fumes

THE automobile is the second largest pollutor of the atmosphere and in some urban localities, is a far greater danger to our health than the smoking of tobacco. In the world there is an automobile for every ten people. These automobiles are responsible for the largest production of poisonous carbon monoxide and nitrogen oxide. The automobile, however, is regarded as an important item of property next only to land and a house. So it would be almost impossible to stop the making and using of automobiles just because they are a major source of pollution. What we can do is to make them less dangerous by fitting them with pollution-control gadgets.

If the automobile owner spends about Rs. 2000/- on a 'Recycler', pollution can be decreased substantially. This gadget gets rid of the poisonous unburnt hydrocarbon compounds in the engine. Though it cannot fully eliminate pollution, it is cheap. The more the owner is prepared to spend, the greater will be the effectiveness of the pollution-control gadget. Another gadget invented a few years ago burns hydrogen and carbon compounds at very high temperatures using a blow torch. An efficient but more expensive gadget called the 'Muffler' removes ninety per cent of the pollution from automobiles.

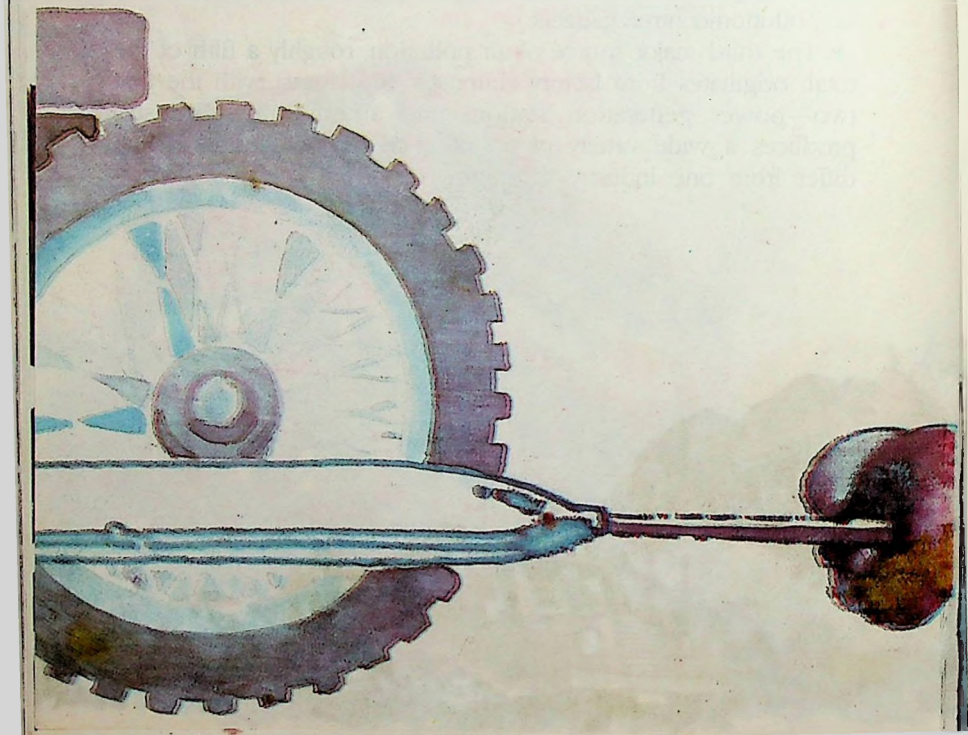
There are other substances released by automobiles which are not only highly poisonous but also difficult to destroy. Lead is a typical example. Lead is dangerous to human and animal life but despite this a lead-bearing chemical is added to certain types of high performance petrol. In the U.S.A. alone, the weight of lead contributing to pollution is more than the combined weight of the people in India and China.

Because of the high cost of pollution-control gadgets, many automobile owners do not buy them. So automobile manufacturers should be directed by the Government to fit them in during manufacture. As a second step, an alternative means of transport like electric trains could be used increasingly. As a further step, owners of old automobiles should be persuaded to fit in pollution-control gadgets.

The third major source of air pollution, roughly a fifth of the total, originates from factory chimneys. In contrast with the first two—power generation stations and automobiles—industry produces a wide variety of pollution-creating chemicals which differ from one industry to another.

With growing industrialisation, the kinds of poisonous chemicals which are released into the atmosphere are steadily increasing. Some of these may affect the health of living matter, in an unpredictable way. Many people in industrial towns are familiar with corroded doors, windows and walls in their homes. If you visit such a town, you can often smell the chemical pollutants in the atmosphere. Those living there may not be aware of the smell because they are used to it.

Developing countries such as India, Thailand and the Philippines have been caught in the spiral of industrial growth and



are not adequately conscious of the dangerous consequences of pollution. In their large cities are becoming evident the horrors of pollution similar to those of the cities of Europe at the beginning of the century. Pollution in the textile city of Kanpur in Uttar Pradesh is six times more than that of the famous cotton city of Manchester in England in the latter half of the nineteenth century. In Kanpur, the factories alone contribute as much pollution as that from all the inhabitants. Bombay is another case in point. Within the next twenty years, the number of factories in and around Bombay will have increased threefold. But even today more than 1,000 tonnes of poisonous chemicals, soot and dirt are emitted into the atmosphere over Bombay. In fact, the average level of the oxides of sulphur present in the atmosphere over Bombay is more than twice the safety level recommended by the United Nations and some areas within Bombay crossed the danger level long ago. We can only hope that our cities do not suffer the fate of London in December 1952. That year, due to some peculiar weather conditions, smoke accumulated for five days in the foggy air. As many as 4,000 people died in this smoke-infected fog. Bombay may experience similar disasters if the present increase in pollution is not checked soon.

We want to breathe clean air but every year we are burning vast amounts of coal and oil which produce the equivalent of four times each individual's weight of pollution. Imagine the pollution if power generation doubles by AD 2000! Within the next thirty to forty years the air we breathe, wherever we are on earth, will no longer be safe. We are slowly endangering life on earth.

The Dusty Future

ASTRONAUTS viewing the earth from a spacecraft circling the globe have reported seeing a continuous blue haze over Central Africa, Brazil and South-East Asia, and a brown haze of dust suspended over the Indian subcontinent, China, West Asia and parts of Africa. Both are due to the thoughtless burning of agricultural wastes and destruction of forests. This shows that the rich industrialised countries are not the only culprits in causing pollution. Recent investigations indicate that tropical grassland fires and the burning of agricultural wastes contribute almost as much pollution as do factories all over the world. There are 2,000,000,000 hectares of burnable land in the world in the form of cultivated land, permanent meadows and pastures. These areas are often subjected to seasonal burning. It is estimated that more than 6,000,000,000 tonnes of agricultural wastes and other vegetation are burnt every year, and dust and soot is being continuously injected into the atmosphere.

In the tropical savannah alone as much as five tonnes of burnable agricultural waste accumulates for each hectare of cultivated land. A number of countries, including many parts of India, practise a 'slash and burn' clearing of rice crop wastes.

Vegetation and agricultural wastes have a great deal of carbon in them. Burning them throws into the atmosphere fine particles of carbon and soot which float high in the atmosphere for a very long time.

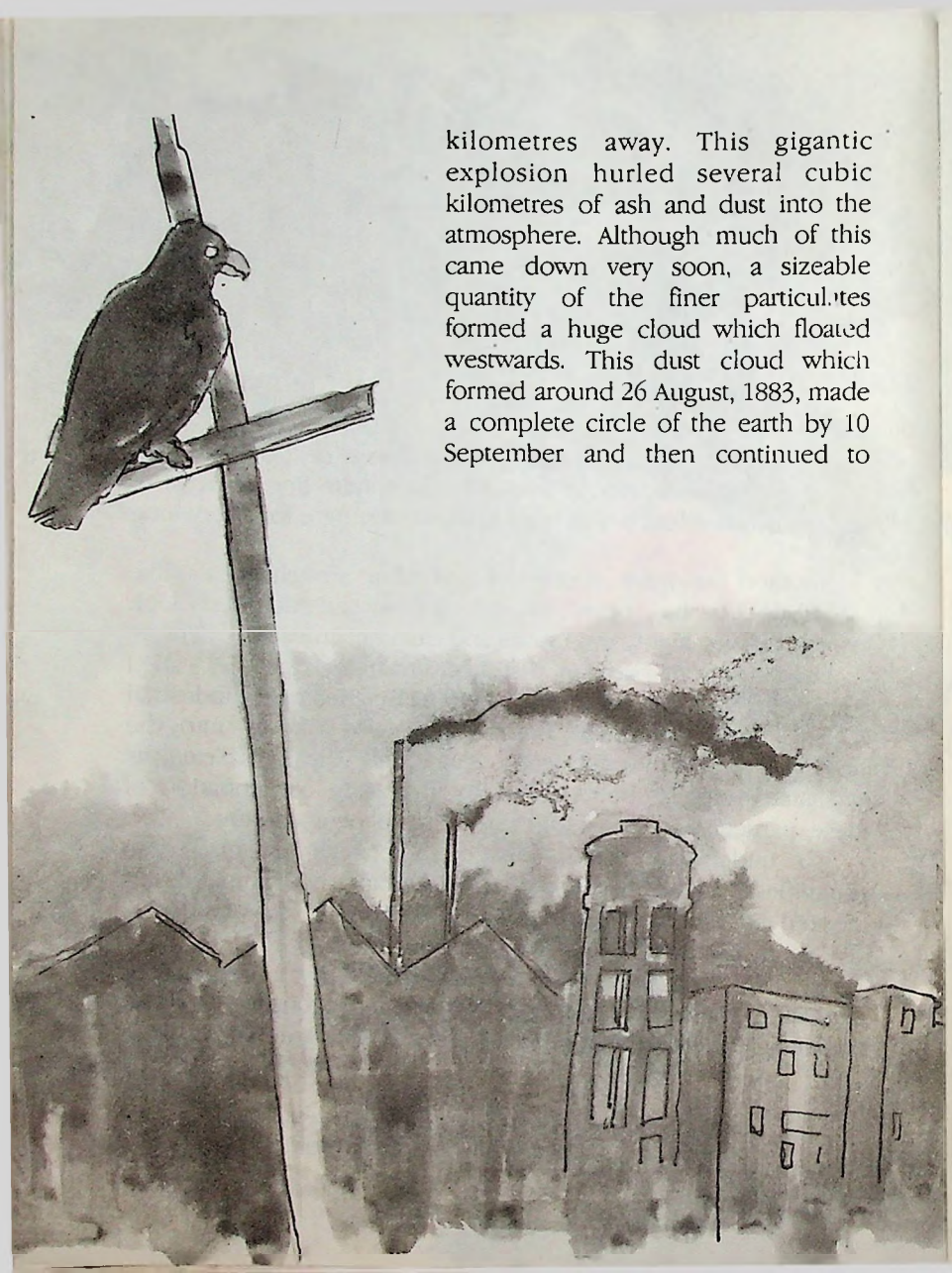
Another important source of pollution are chemicals like D.D.T. D.D.T. has been in use for several decades. Such insecticides are highly poisonous and can contaminate foodgrains.

Dust and soot particles that float in air are together called 'particulates'. Particulates may be man-made from industrial activities and agricultural burning and also thrown into the atmosphere by nature during the eruption of volcanoes. Scientists and meteorologists believe that an increasing concentration of these particulates can change the climate of a country.

To understand how climate can change by man-made pollution it is first necessary to understand how climate was affected by the eruption of major volcanoes in the past.

Let us go back a little in history.

In 1883, the Indian Ocean was rocked by a tremendous explosion caused by the eruption of the Indonesian volcano 'Krakatoa'. Reverberations were felt as far as Rodrigues Island, 5,000



kilometres away. This gigantic explosion hurled several cubic kilometres of ash and dust into the atmosphere. Although much of this came down very soon, a sizeable quantity of the finer particulates formed a huge cloud which floated westwards. This dust cloud which formed around 26 August, 1883, made a complete circle of the earth by 10 September and then continued to orbit the earth many times. During its journeys the cloud began spreading and very soon the dust fanned out and almost covered the entire globe. The atmosphere became somewhat opaque and the rays of the sun were able to come through with less strength. The earth's climate is dependent on the rays of the sun, so the weather in several parts of the world was noticeably affected. Moreover dust particles floating in the atmosphere for a long time over large areas will reflect more sunlight back into space. This reduces the number of rays falling on the surface of the earth. Energy from the sun is in the form of light. When it reaches the surface of the earth, it may be sent back into space in other forms

like heat. The dust cover in the atmosphere prevents a small part of the solar rays from coming in but the heat energy from the surface somehow finds its way into space in large quantities. Therefore, the energy going out will be more than the energy coming in, thus noticeably lowering the temperature. The energy available in the atmosphere is manifest in the form of atmospheric wind, ocean tides, the formation and precipitation of clouds and cyclones. This energy may become less and less and thus affect the weather. If this continues for a few years, it may affect the climate (the long term trends of the weather) also. Though scientists are certain that greater dust in the atmosphere influences weather and climate they are not sure to what extent it does so.

Dust pollution is further caused by an unexpected source. In recent times, human interference with nature has increased the amount of dust thrown into the atmosphere by winds. Agricultural activity is also responsible for big dust storms in the Great Plains of North America. We in India are familiar with the dust storms arising over the Thar desert which sweep dust to areas as far off as Delhi. This is believed to be the result of man-made changes in the landscape like the over-grazing of grasslands by cattle.

Adding to the dust in the atmosphere are gases like sulphur dioxide and hydrogen sulphide which are ejected continuously from the chimneys of factories. They are also released by the decay of vegetation and other biological matter. Although these gases disperse in a few hours, yet within this time, the sulphur dioxide reacts with ammonium to produce fine particles of ammonium sulphide. These particles float in the atmosphere for a long time. Thus we see that man is outdoing nature in contributing to a dusty future.

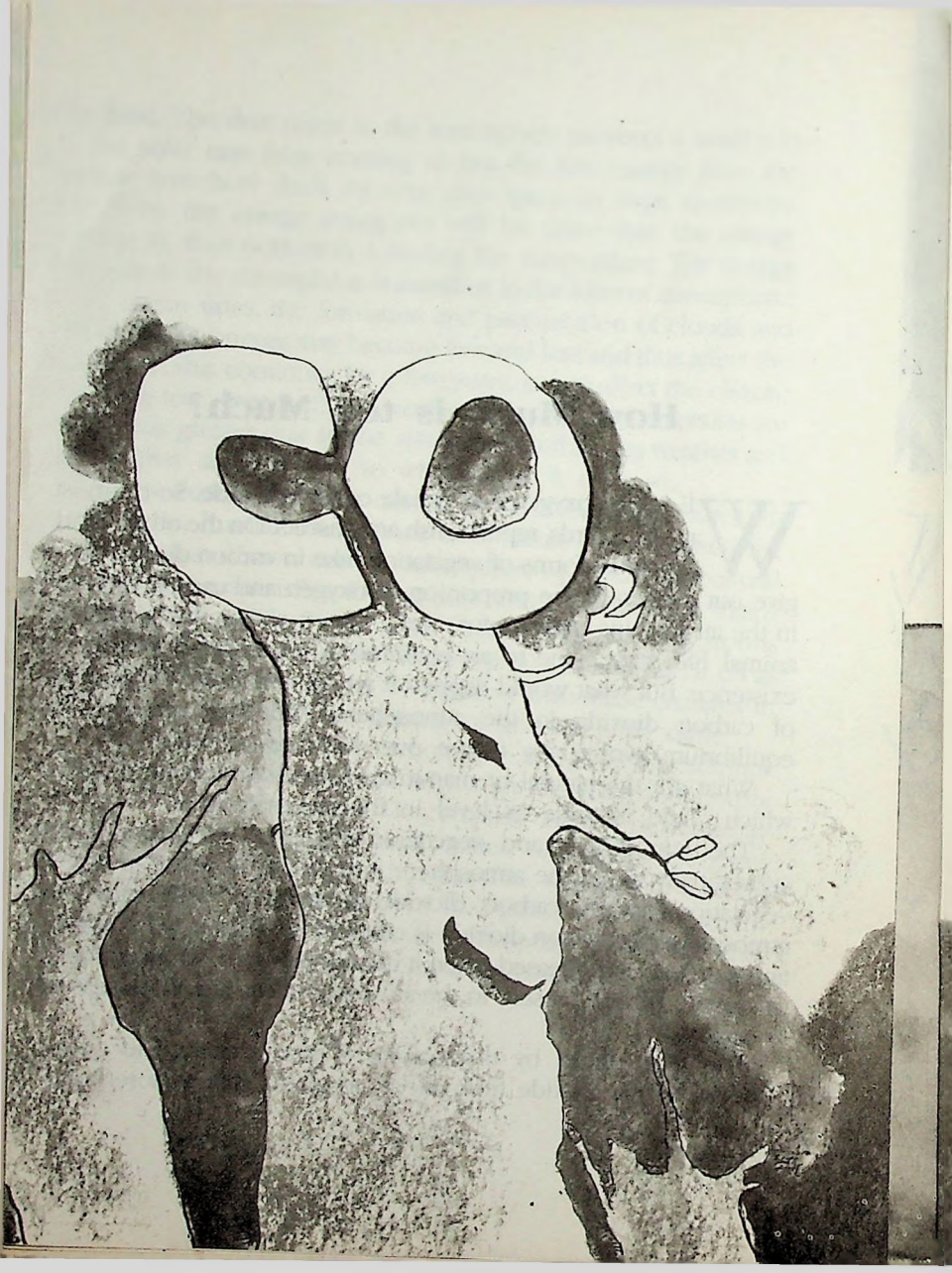
How Much is too Much?

WE inhale oxygen and exhale carbon dioxide. So do most animals, birds, reptiles, fish and insects. On the other hand, almost all forms of vegetation take in carbon dioxide and give out oxygen. If the proportion of oxygen and carbon dioxide in the air remains constant for a long time it means that plant and animal life have come to an equilibrium regarding each other's existence. But what would happen if we increased the proportion of carbon dioxide in the atmosphere? Would it change the equilibrium evolved by nature over millions of years?

What are the natural or man-made sources of carbon dioxide which could increase its level in the atmosphere?

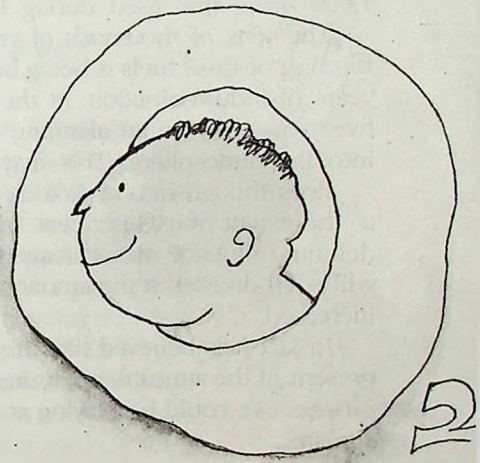
The atmosphere and vegetation exchange carbon dioxide substantially. From the atmosphere it goes into vegetation. When vegetation decays, carbon dioxide is released back into the atmosphere. As carbon dioxide is taken in by vegetation in spring and summer and released when it decays in winter, so the amount of carbon dioxide present in the atmosphere changes from season to season.

The role played by the oceans is also crucial. The ocean absorbs carbon dioxide from the atmosphere, much more being



concentrated on the deeper portions than near the surface. It also releases carbon dioxide. If the amount of carbon dioxide decreases, we may hope that the carbon dioxide released from the ocean will compensate for it. But what would happen, if the amount in the atmosphere increases rather than decreases? Will the ocean absorb the excess carbon dioxide?

Despite a lot of research, there is no definite answer to this question. Some scientists believe that even if the ocean absorbs a part of the extra load of carbon dioxide in the atmosphere, it may



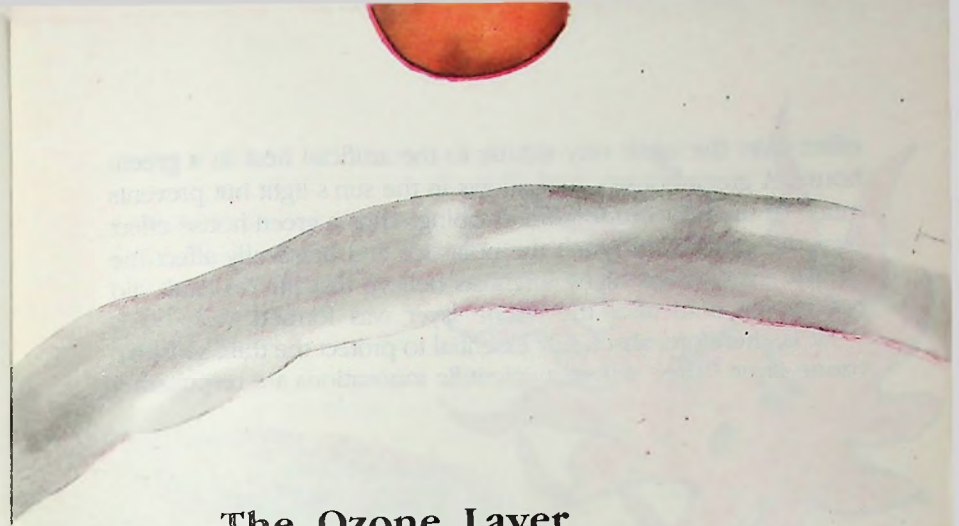
store it only temporarily and release it back into the atmosphere in the course of time. Other scientists hold that the extra load will be, by and large, transferred to vegetation and the ocean. If the first theory is correct, then carbon dioxide will be a major pollutant about which we have to be very careful.

Carbon dioxide is also absorbed into the ground from the atmosphere for the manufacture of fossil fuels like coal and oil—but only a tiny fraction, one in 10,000 tonnes. However, when these fuels are burnt the carbon dioxide released is more than 1,000 times that used during fossilisation.

The tens of thousands of years of nature's hard work in the forming of fossil fuels is being burnt almost completely within 100 years of industrialisation. At the present tempo, the next twenty-five years will see an alarming rate of release of carbon dioxide into the atmosphere. This may upset nature's balance.

Even though carbon dioxide is present in the atmosphere only to the extent of 0.03 per cent, many scientists believe that it has a definite influence over climate. Even if this claim is partly true, it will spell disaster, if the amount of carbon dioxide is substantially increased.

In fact it is believed that the level of carbon dioxide that was present in the atmosphere during the Ice Age may reappear by this process. We could be playing around dangerously with the earth's climate.



The Ozone Layer

BETWEEN heights of twenty and thirty kilometres from the ground the earth's atmosphere is covered by what is called the 'ozone layer'. A few kilometres thick, this layer is spread over the entire globe and shields all living things below from ninety-nine per cent of the sun's ultra-violet rays—rays beyond the violet band in the spectrum of light. Without the protection of this layer the full blast of the ultra-violet rays would reach the surface of the earth and scientists have found that increased exposure to ultra-violet rays can cause skin allergies and even skin cancer in human beings and animals.

Moreover, scientists believe that the climate on earth as we know it today is due to the ozone layer. The destruction of this layer could create an

effect over the earth very similar to the artificial heat in a green-house. A green-house's roof allows in the sun's light but prevents much of the heat inside from escaping. Thus a green-house effect over the earth would melt the polar ice and drastically affect the climate everywhere. Many scientists believe that life on earth did not evolve until after the ozone layer was formed.

It is, therefore, absolutely essential to protect the thin, sensitive ozone layer. Three different scientific innovations are responsible

for releasing into the atmosphere the dangerous chemicals which are destroying the lower part of the ozone layer.

Today more and more people are travelling either for business or as tourists. They are impatient to get to their destinations and demand faster and faster means of transport. The age of supersonic transport (S.S.T., aeroplanes that fly at speeds exceeding that of sound) came into being to satisfy this demand. The U.K., France, the U.S.A. and the U.S.S.R. invested thousands of millions of dollars in the development of such aeroplanes. Unfortunately, S.S.T. is a source of pollution of the upper atmosphere. The exhaust from the jet of these aeroplanes contains the oxides of nitrogen, especially nitric oxide, which can destroy the ozone layer. Though

many countries are now considering banning S.S.T. flights over their territory, not all are doing so. The effect may not be very evident until a few hundred aeroplanes fly through the upper atmosphere around the world. If so many aeroplanes are put into operation there may be a very real threat to the ozone layer even before AD 2000.

When nuclear bombs such as those which destroyed the Japanese cities of Hiroshima and Nagasaki explode, large quantities of oxides of nitrogen are created. These rise into the upper atmosphere and may reach the ozone layer. Pressure from scientists has reduced the danger to the ozone layer from this source. Almost all countries, except France and China, have stopped atmospheric nuclear explosions.

Another hazard to the delicate ozone layer is posed by aerosol cans like hair-dye or perfume-spray containers. Besides the liquid to be sprayed like the hair-dye or perfume these cans contain certain gases like fluoro-carbon introduced at high pressure, to help propel the liquid which is suspended as small particles in it. When a button is pressed on the can, the liquid and gas combined form a mixture called 'the aerosol'. Hundreds of products have come into the market based on the principle of the aerosol spray. Scientists are campaigning with only limited success for the banning of aerosol containers.

Scientists are worried about the safety of life on earth in the next few decades. Short-sighted commercial interests oppose the ban on the use of things producing ozone destroying chemicals. Many of the effects such as the increase of cancer cases may not be noticeable until about fifteen to twenty years later but the well-being of the new generation will be affected by the time they are middle-aged.

The Garbage Mountain

THE biggest obstacle to clean living is pollution from solid wastes. Do you know that, at present, all over the world, people throw away 10,000,000,000 tonnes of solid wastes annually? This may be something as simple as animal dung or as complex as that created by scientific and technological advances—plastic cans, glass bottles, polythene bags, paper, nylon and even cars that have become junk. If we pile these up at sea-level conically with a base of one kilometre radius, the peak would be higher than Mount Everest. So, we are creating at least one Mount Everest of rubbish every year! Almost half of this is made of animal dung and nearly a third of mineral and industrial wastes. The rest is composed of left-overs from crops, household, commercial and municipal wastes. The outer limit of the problem of solid wastes, is the plight of Americans and Europeans who do not know what to do with their discarded cars. The beautiful landscape of North America and Europe is pock-marked with as many dumped cars

and other vehicles which are junk as there are families in India! We are making this once beautiful planet of ours uglier and uglier day by day.

Why is solid waste such a serious problem? For one thing, every cubic metre of garbage can foster about 750,000 flies, not to mention rats, mice, mosquitoes, cockroaches, etc. It becomes the breeding ground for disease-bearing bacteria. Furthermore it spoils the landscape and devours our living space. Every passing day brings in more solid wastes which cannot be destroyed easily. Today's industry is greatly contributing to this menace. In the market you get all kinds of things packed nicely in plastic bags. After use, you throw away the plastic bag. Even if reused for sometime, as soon as a hole or two appear in them, you throw them away. The number of such use-and-throw items is growing.

The city's garbage trucks carry away a fantastic mixture of discarded things. The portion which stinks is the easiest to get rid of. Much of the problem is posed by the synthetic stuff which cannot be destroyed by any simple means. That is why these things are called 'non-degradable'. If you bury a nylon handkerchief in the ground, you will find it a few years later in almost the same condition. Nylon and other synthetic materials are non-degradable. Bacteria in the soil which feast on garbage of biological origin cannot eat synthetic materials. All over the world, every year, we throw away 150,000,000,000 cans, 80,000,000 tonnes of bottles and 150,000,000 tonnes of paper and plastic, creating larger and larger mountains of garbage whose disposal we are leaving to the future.

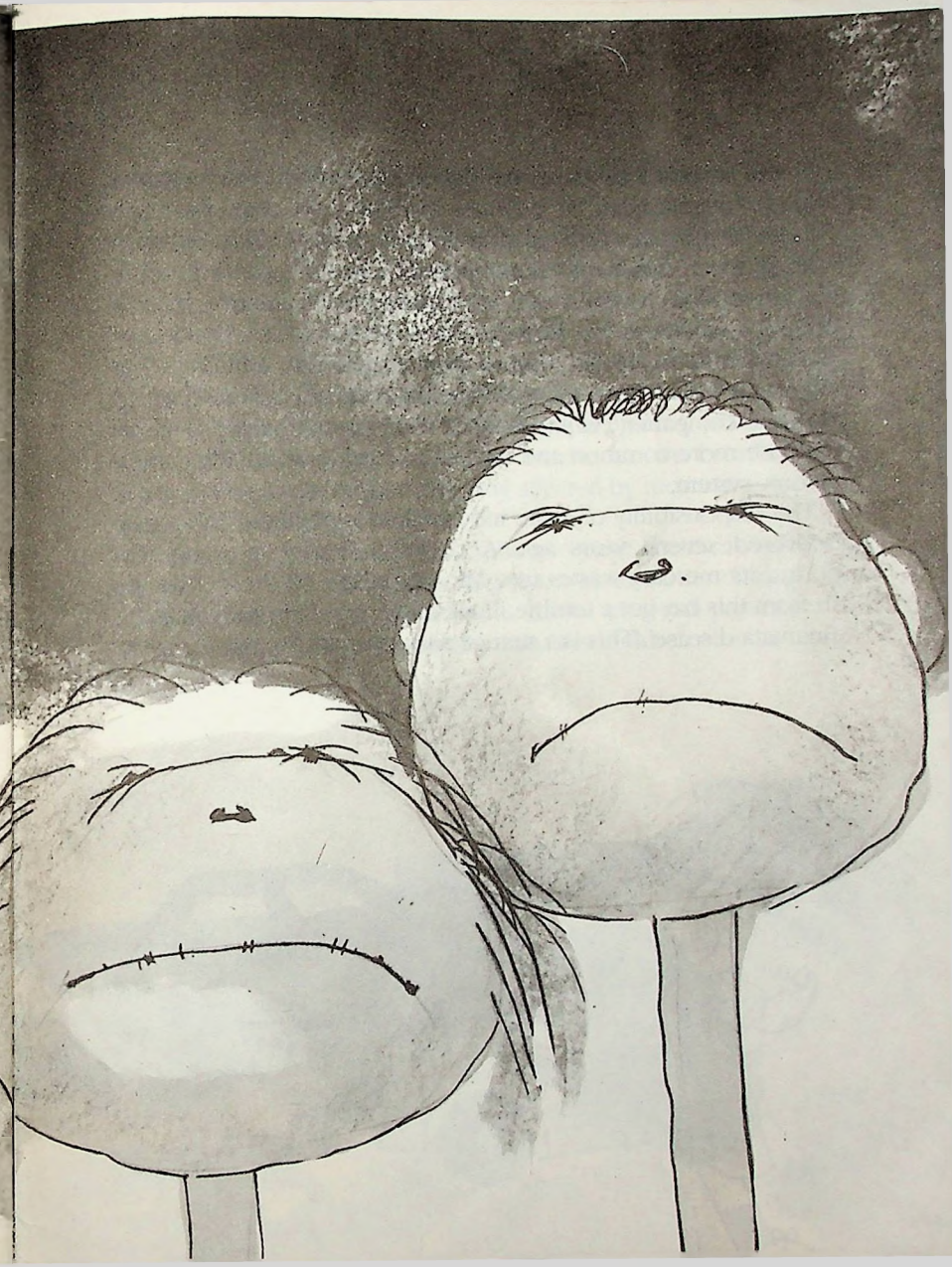
Children and Pollution

THE saddest part of the pollution story is that the health of children is more affected by air pollution than that of adults. Why is this so?

In children, more air is exchanged between the lungs and the atmosphere than in adults. This is because children take part in more physical activity. If more air enters their lungs so do proportionately more pollutants. In fact, young children inhale twice the quantity of pollutants per kilogramme of body weight than adults.

Moreover, many other air pollutants like lead are found at a level of one metre from the ground and not at two metres. This means that children breathe air with more pollutants than adults who are taller than them. In addition, when playing, children stir up dust on which pollutants have settled.

Little children often put into their mouth things like the coloured pages of comic books and painted toys. These contain lead which enters their intestines. The effects of lead on health are greater when there is a deficiency of vitamins, minerals and protein. This is often the case when children are growing up.



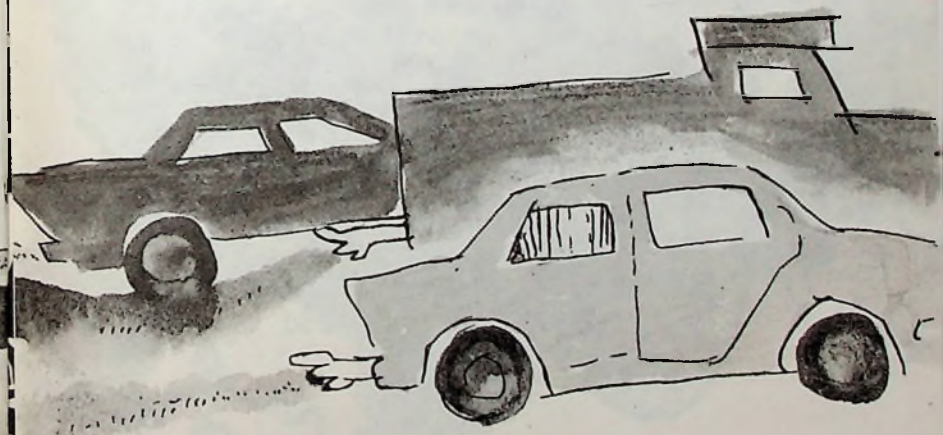
These are just a few reasons why children are more affected by pollution than adults.

Even at the present level of pollution, a few million children under fourteen may have been exposed to health hazards. In a few decades, pollution may result in chronic health disturbances. If pollution continues to increase, by AD 2000 the number of affected children may grow to several tens of millions. The dangers to health due to pollution for children below fourteen would be comparable to those faced by chain-smokers. Bronchitis would be more common and carbon monoxide would affect their nervous system.

The responsibility of some industrialists is obvious from a case discovered several years ago. A chemical factory in Japan was pouring its mercury wastes into Minamata Bay. All those who ate fish from this bay got a terrible illness now popularly known as the 'Minamata disease'. This is a strange ailment of the nervous system. It killed many and crippled numerous others. Children were the worst affected. Even unborn children in their mother's wombs were afflicted. The worst of it was that this particular factory had been throwing out this poison into the waters for fifty years without anyone being aware of the hazard. The danger is, therefore, our ignorance of the poisonous materials around us. The chemical pollutants which caused the Minamata disease are all around us in small dosages. Mercury is used in thousands of factories which manufacture plastics, paper, paints, polishes, etc. Many such wastes get suspended in the air we breathe. It is possible that some of us are already affected by mercury poisoning without even being aware of it.

Lead is probably the worst of the air-borne chemicals affecting the mental health of children. We learnt in an earlier chapter that even the exhausts of automobiles throw up lead particles.

In the case of noise pollution too it is children who are most



vulnerable. Statistics have shown more child deaths near London airport than in the rest of Britain and doctors feel that noise may be responsible. Without doubt too much noise damages the hearing and may lead to mental illness.

The effects of pollution are often evident at a considerable distance from the place where the substance was first applied and even a long time afterwards. In twenty years our water supply could contain concentrations of nitrates originally applied as fertilizer which could threaten the capacity to carry oxygen in the blood of children.

We don't seem to be aware enough that lack of action concerning pollution is putting the health and well-being of a whole generation at stake.

Fighting the Menace

UNFORTUNATELY it is only recently that we have begun questioning the wisdom of our ways. If by the sweep of a magic wand we stopped contributing to the pollution of air, water and land the world would be a happier and healthier place. But such magic wands do not exist. To stop pollution requires discipline and determination. It also demands organized effort and Government regulation.

The example of the river Thames which flows through London is worth mentioning. Around 1950 the river had become dirty and smelly and so filled with poisonous chemicals from industrial and domestic waste that it would not sustain any life. A decade later consciousness of the damage resulted in regulations to restrict the discharge of industrial waste and sewage into the river. Shortly afterwards the level of oxygen in the water increased and fish began to be found once again in areas where they had long been absent.

To help fight the menace of pollution, we can follow certain simple do's and don'ts in our day-to-day life. We must be able to distinguish between degradable and non-degradable wastes. They should only be disposed of in garbage-bins provided by our

municipalities. We must reduce the use of non-degradable material like plastic bags and glass bottles. Let us help organizations which recycle such material. If we buy a car, we must insist on having pollution-control gadgets fitted in it. Our farmers must not burn agricultural wastes recklessly. Aerosol cans should be banned.

Our primary aim should therefore be to recycle and reuse discarded materials, avoid waste and repair the damage we have already done to our environment. It is our world. It concerns us.

Printed at Saraswati Art Printers, 8247/2, New Anaj Mandi, Delhi-110006