TEXT 1

The simplest definition of water pollution is "the loss of any of the actual or potential beneficial uses of water caused by any change in its composition due to human activity". The beneficial uses of water are varied and include its use for drinking and for domestic purposes, for watering livestock and the irrigation of crops, for fisheries, for industry and for food production, for bathing and for recreational use.

Pure water – H20, water absolutely free from any substances dis­solved in it  – does not exist outside the laboratory, as natural water contains dissolved gases and salts. These substances are often the very factors which make water suitable for particular beneficial uses.

It cannot be expected that natural waters will be immediately suit­able for the whole range of beneficial uses. Nobody should expect to be able to drink the water in any river, for instance, without its being treated before use. In its natural state, depending on local usage, the weather and other factors, water may be turbid or very highly col­oured, and hence unattractive to the user. More importantly, river water is most unlikely to be microbiologically pure, that is, free of those min­ute organisms (bacteria and the like), some of which can cause disease in humans.

In these cases, water pollution means that, because of some human activity water is no longer suitable for some potential use, such as drinking water, even after treatment. To illustrate, if a river from which the water is taken for treatment for drinking receives a discharge of chemi­cal or possibly toxic waste, the water may be made completely unsuit­able for eventual distribution. The local authority treatment works will usually have been designed to remove the natural contaminants – col­ouring matter, particles causing turbidity, micro-organisms, etc. – and therefore may be unable to cope with a heavy load of completely for­eign matter such as a chemical waste.

TEXT 2

The majority of pollution instances are caused by the sudden or continuing, accidental or deliberate discharge of polluting material which, on first consideration, might not seem harmful or offensive at all. Such pollution events are caused by the discharge of non-toxic or­ganic matter – waste from creameries, sewage (treated or untreated), manure slurry, food production waste and silage effluent – to waterbodies.

When there is an uncontrolled discharge of organic material (sew­age, milk, etc.) the constraining factor on the growth of the bacterial pollution is removed at a stroke. There is an immediate abundance of food and, initially, a corresponding plenitude of dissolved oxygen. Bac­terial growth is promptly stimulated and the population increases rap­idly, consuming the available oxygen as it does so.

The growth of bacteria tends, therefore, to reduce the amount of oxygen dissolved in the water. The extent of oxygen depletion which occurs depends on the rapidity with which the stream takes up oxygen from the atmosphere, i.e., its re-aeration capacity. This capacity is greatest in fast-flowing, turbulent streams and least in deep, slow- flowing rivers. In addition, the loss of oxygen may be counteracted by the photosynthesis of green plants which produce oxygen during day­light.

Where the degree of pollution is severe these compensating factors may be insufficient to prevent the oxygen content of the water decreas­ing to very low levels, or, in the worst case, to anaerobic conditions, where there is a complete absence of free oxygen.

When toxic pollution occurs the effects are often direct and imme­diately apparent – fish are killed, the flora and fauna of the water re­ceiving the pollution may be wiped out, different visible effects will be noticeable, and there may be noxious smells. The principal effects are those of direct poisoning by the hazardous pollutants discharged. The careless or, even worse, premeditated dumping of toxic wastes such as waste metal solutions is most reprehensible, particularly as its conse­quences can be far-reaching.

TEXT 3

At the outset it is important to clarify two terms, sewerage and sewage, because they are often used incorrectly. Sewerage is a system of pipes used to collect sewage which is the wastewater dis­charged from domestic premises. Domestic sewage consists of human wastes, paper, vegetable matter. This type of waste is organic because it consists of compounds of carbon and can be broken down by microor­ganisms into simpler compounds which are stable and not liable to cause a nuisance. Sewage can consist of 99.9 % water and 0.1 % solids.

Besides domestic sewage there is industrial waste. Many industrial wastes are also organic in composition and can be treated by microor­ganisms in the same way as domestic sewage. This type of treatment is called biological treatment and the strength of the sewage is measured in terms of biochemical oxygen demand. This is a measure of the amount of oxygen used by the microorganisms in breaking down the sewage into stable compounds.

Thus, in a town the sewerage system will collect the sewage from domestic, commercial, and industrial premises and carry it to the near­est river or to the sea. The dilutions available in the receiving water has traditionally determined the extent of treatment necessary. In modern treatment works sewage goes through several stages of treatment. Preliminary treatment deals with large solids which are removed by screening or ore macerated and returned to the sewage flow. At this stage grit is removed in special tanks. The sewage then receives primary treatment which consists of allowing the sewage into sedimentation tanks where solids settle out in the form of sludge. The next stage is secondary treatment or biological treatment in which mi­croorganisms are used to take organic matter out of solution so as to form a sludge which can be settled out in a final settling tank. Tertiary treatment can reduce the organic matter content still further if this is necessary. Nutrient removal consists of reducing the phosphorus and nitrogen in the sewage so as to prevent plant growth in the receiving waters.

TEXT 4

Irrigation is the artificial application of water to soil to assist in the production of crops. In general, irrigation is most exten­sively practiced in arid regions where agriculture without it is not profitable but it is also used to lands of the semi-arid regions to increase the yield and to special crops in humid regions such as rice, garden flowers and vegetables.

The surface of the Earth is composed of land and water, the latter being roughly three fourths of the area and not habitable by man. More than half of the remaining one fourth of land area is either too cold or too rocky for cultivation and the major por­tion of the rest is too arid for the production of crops.

Thus, the area naturally available for cultivation is a very small proportion of the whole. Fortunately, man can increase the area for cultivation by artificially applying water to soil where nature fails to do this.

An irrigated region has certain advantages over a humid re­gion. There is much advantage in being able to apply the water at the proper time and in the quantity needed. There is much ad­vantage in being able to stop application of water at will. The soils of arid regions are usually better supplied with the mineral plant foods which have not been washed out by excessive rains. Sunlight providing life and growth is more intense and constant in an arid than in a humid region. The yields under irrigation may be made larger and more stable, than under natural precipi­tation, provided sufficient care and skills are applied.

The choice of a method of irrigation depends upon topogra­phy, soil conditions, crops to be grown, value of crop products, available water supply and other factors.

Improper irrigation may waste large amounts of water and reduce crop yields. It frequently results in plant nutrients being leached from the soil. Excessive application of water causes high water table, waterlogging and salinity of soil. This may be corrected only by the construction of expensive drainage systems. Very often drainage works are constructed together with irrigation development to discharge both excess water and excess salts.

TEXT 5

Hydrogen is the simplest element. An atom of hydrogen con­sists of only one proton and one electron. It's also the most plen­tiful element in the universe. Despite its simplicity and abun­dance, hydrogen doesn't occur naturally as a gas on the Earth – it's always combined with other elements. Water, for example, is a combination of hydrogen and oxygen. Hydrogen is also found in many organic compounds, notably the hydrocarbonsthat make up many of our fuels, such as gasoline, natural gas, methanol, and propane.

Hydrogen can be separated from hydrocarbons through the application of heat – a process known as reforming. Currently, most hydrogen is made this way from natural gas. An electrical current can also be used to separate water into its components of oxygen and hydrogen. This process is known as electrolysis.Some algae and bacteria, using sunlight as their energy source, even give off hydrogen under certain conditions.

Hydrogen is high in energy, yet an engine that bums pure hy­drogen produces almost no pollution. NASA has used liquid hy­drogen since the 1970s to propel the space shuttle and other rockets into orbits. Hydrogen fuel cells power the shuttle's elec­trical systems, producing a clean by-product – pure water, which the crew drinks.

A fuel cell combines hydrogen and oxygen to produce elec­tricity, heat, and water. Fuel cells are often compared to batter­ies. Both convert the energy produced by a chemical reaction into usable electric power. However, the fuel cell will produce electricity as long as fuel (hydrogen) is supplied, never losing its charge.

In the future, hydrogen could also join electricity as an impor­tant energy carrier. An energy carrier moves and delivers energy in a usable form to consumers. Renewable energy sources, like the sun and wind, can't produce energy all the time. But they could, for example, produce electric energy and hydrogen, which can be stored until it's needed. Hydrogen can also be transported (like electricity) to locations where it is needed.

TEXT 6

The phenomenon of over-enrichment of waters by so-called nutri­ents, principally nitrates and phosphates, is known as eutrophication. Al­though eutrophication is of primary concern in lake waters, its effects are becoming more pronounced in rivers. These include greatly in­creased weed growth, leading to the blockage of channels, siltation, and in some cases, to deoxygenation.

The effect of the nutrients is one of fertilisation, where the growth of attached plants below the waterline in rivers and of planktonic algae in lakes is stimulated, often to a marked extent. The increase in the in­cidence of algal "blooms" and scums in lakes in recent years has at­tracted considerable public attention and concern.

In inland surface waters, the presence of excess levels of phos­phate is the primary factor governing the extent of eutrophication, while in estuarine and coastal waters nitrate is more likely to be the control­ling factor. Both nutrients are present in abundance in many wastes – notably sewage, even when it is treated. An obvious means of control is to restrict the volumes of nutrient-bearing wastes reaching receiving waters, another being the provision of so-called "tertiary treatment" of wastes to remove the nutrients. The key to the resolution of water problems is control by water quality management planning, by the enforcement of national and EC standards, by the licensing and policing of discharges, by following approved procedures in agriculture, and by good environmental aware­ness on the part of the public.

Control, not prohibition, is the keyword: it is unrealistic to prohibit all discharges to our water bodies. Instead, the careful, diligent control of discharges to rivers and lakes will go a long way towards restoring and preserving the good quality of many water bodies.

TEXT 7

The atmosphere is a thin film of gases which envelops our planet and makes it habitable. Without this layer, there would be no life on earth. We know that the health of plants and animals including humans depends upon an unpolluted atmosphere yet we are putting all kinds of poisonous waste into it. Gases produced when fossil fuels are burnt cause acid rain which can damage forests, lakes, rivers, the land and the plants and animals living there. Developed countries which are depend­ent on fossil fuels to maintain their high standards of living are the main culprits.

Acid rain is the popular term used to describe acid precipitation. As well as rain, it includes mist, snow and dry deposition. Dry deposi­tion refers to pollutants which are deposited on the environment before they have a chance to be absorbed by the moisture in the atmosphere.

Rainfall is naturally acid because it absorbs carbon dioxide in the atmosphere and becomes a weak carbonic acid with a pH between 5 and 6. The major causes of acid rain are the sulphur dioxide and nitro­gen oxides produced when fossil fuels such as coal, oil and gas are burned. Sulphur dioxide and nitrogen oxides are released into the at­mosphere where they can be absorbed by the moisture and become weak sulphuric and nitric acids, sometimes with a pH of around 3. Most natural gas contains little or no sulphur and causes less pollution.

Coal fired power stations are the major producers of sulphur diox­ide, although all processes that bum coal and oil contribute. Every year about 45 million tonnes of sulphur are put into the atmosphere in Europe. After a drop in the 1980, amounts are now increasing again.

Vehicles, especially cars, are responsible for most of the nitrogen oxides in the atmosphere. Some come from the vehicle exhaust itself, but others form when the exhaust gases react with the air. Exhaust gases also react with strong sunlight to produce poisonous ozone gas which damages plant growth and in some cases, human health.

TEXT 8

Ozone is a gas with the formula O3. At ground level, it is produced from pollutant gases such as nitrogen dioxide (which can be emitted from vehicle exhausts) reacting with sunlight. Here it is harmful, ad­versely affecting plant growth and the respiratory systems of animals, including humans. However, high in the Earth's atmosphere, about 20­35 km above the surface, there is a layer in which relatively large amounts of ozone are found.

The ozone layer is of great importance to all living things on Earth, because it absorbs a high proportion of the ultraviolet light from the sun. Ultraviolet light can increase the risk of skin cancers, or mela­nomas. It can also cause cataracts to develop, and appears to have harmful effects on the growth of many types of plants.

It was realised that the loss of high-level ozone was caused by the re­lease of CFCs into the atmosphere. CFCs were widely used as aerosol propellants and as coolants in refrigerators. No-one thought that they might have any harmful effects, because they are extremely unre­active.

However, we now know that their unreactivity is one of the major factors that contributes to their damaging effects in the high atmos­phere. CFCs released at ground level slowly move throughout the at­mosphere, eventually reaching the ozone layer. They remain unchanged throughout this time, lasting as much as 100 years without breaking down. However, when they reach the ozone layer, the chlorine atoms that they contain begin to react with ozone molecules, breaking them down into oxygen.

Most developed countries have now completely phased out the use of CFCs. Alternatives have been developed that do not – so far as we know – have such harmful effects. And it looks very much as though the problem is close to being solved. But it is going to take a while be­fore the ozone layer is back to normal, because we cannot remove the CFCs that are already there. Still, this does look like a success story, and gives encouragement that it is possible for international action to be taken to reverse damage done to our environment.

TEXT 9

The amount of many greenhouse gases in the atmosphere is in­creasing. C02 is the most common greenhouse gas and is responsible for almost half of the extra warming that is taking place. However, some of the other gases are more effective. For example, some CFCs are up to 10 000 times more effective than C02.

It is generally accepted that greenhouse gases have already raised the temperature of the Earth by between 0.3° C and 0.7° C. By 2020, this is likely to have grown to between 1.5° C and 4.5° C, a rate of in­crease unprecedented in the history of the Earth.

The Effects of Global Warming:

1. *Rise in sea level*: Higher temperatures will cause sea level to rise because the water in the oceans will expand and the polar ice sheets will get smaller, releasing more water into the oceans. It has been calculated that levels will rise by about 1.5 metres in the next 40 years. While developed countries may be wealthy enough to afford sea de­fences, poorer countries will not. About 15 million people in Bangla­desh are likely to lose their agricultural land and be made homeless.
2. *Climatic changes*: The world is already getting warmer. 1980, 1981, 1983, 1987 and 1988 have been the warmest years since reliable records began. Rainfall is likely to increase in some areas but decrease in others as the climatic belts move to new positions. More extreme weather conditions are being experienced and the climate is becoming less predictable. Planners of dams and irrigation schemes are finding their task is becoming very difficult because the climatic data from the past is no longer a reliable guide to what will happen in the future.
3. *Agriculture*: CO2 is a natural fertilizer and most plants will grow larger and faster but weeds will also grow better. Pests too could be more of a problem. Climatic changes may more than counteract any benefits, for example, in Canada, rainfall increases of around 18 % could lower wheat yields by 25 %, while the drought in the mid-West of the USA in 1988 was almost certainly due to the greenhouse effect.

TEXT 10

A biome is a major land ecosystem, a large land area that has a distinct kind of plant life. It may include ecosystems of many kinds, but the whole arae is distinguished by a particular kind of plant life such as grassland, rain forest, or whatever characterizes the biome.

The location of biomes over the earth is determined mostly by climate, especially by rainfall and temperature. And climate itself is determined by many factors including latitude (distance from the equator), ocean currents, topography, and the prevailing winds.

The biomes themselves don't begin and end sharply. They blend together at their borders, sometimes over a span of many miles. This zone between two biomes or between two ecosystems is called an ecotone. There are ecotones all around us – the shore of a pond, the bank of a stream, the edge between a forest and a meadow. Usually there is a great variety of life in ecotones because the animals living there have the best of two worlds, getting food, shelter, and other necessities from two different ecosystems. .

Within the boundaries of biomes you may find areas with plant life quite different from that of the whole biome. Often this is an effect of topography. The climate at the top of a mountain ridge is cooler than that of the surrounding land, so plants usually found in a more northern biome may grow on the ridge.

Even though the word "biome" may be new to you, you often think in terms of these major ecosystems. The words "desert" or "prai­rie" bring to mind pictures of these areas, with their characteristic plants and animals.

The system of classifying the world's ecological systems into biomes is used to categorize similar communities on a broad, regional scale. Classifying biomes relies upon the outward appearance of the dominant vegetation types in an area. Biomes differ in their productiv­ity and biodiversity. Equatorial regions have the highest productivity and biodiversity, and both tend to decrease at higher latitudes as with terrestrial systems. We can also divide marine and freshwater systems into broad categories that differ in biodiversity and productivity.