

## 2. Water Pollution

Water pollution is the contamination of water in water bodies such as rivers, oceans, lakes and swamps. This means that one or more substances have built up in water to the extent of causing problems to people, animals and plants.

Addition of certain substances to the water such as organic, inorganic, biological, radiological, heat, which degrades the quality of water so that it becomes unfit for use. Water pollution is not only confined to surface water, but it has also spread to ground water, sea and ocean.

So, whether or not water is considered to be polluted will depend on what that water was going to be used for.

### Causes of water pollution

There are numerous causes of water pollution. The main ones are listed below: Types of sources

#### 1. **Point Sources**

- It is directly attributable to one influence. Here pollutant travels directly from source to water.
- Point sources are easy to regulate.

#### 2. **Diffuse or non-point source.**

- It is from various ill-defined and diffuse sources. They vary spatially and temporally and are difficult to regulate.

The main sources of water pollution are as follows:

1. Community waste water: include discharges from houses, commercial and industrial establishments connected to public sewerage system. The sewage contains human and animal excreta, food residues, cleaning agents, detergents and other wastes.
2. Industrial Wastes: The industries discharge several inorganic and organic pollutants, which may prove highly toxic to the living beings.
3. Agricultural sources:

# Fertilizers contain major plant nutrients such as nitrogen, phosphorus and potassium.

Excess fertilizers may reach the ground water by leaching or may be mixed with surface water of rivers, lakes and ponds by runoff and drainage.

# Pesticides include insecticides, fungicides, herbicides, nematocides, rodenticides and soil fumigants. They contain a wide range of chemicals such as chlorinated hydrocarbons, organophosphates, metallic salts, carbonates, thiocarbonates, derivatives of acetic acid etc. Many of the pesticides are non-degradable and their residues have long life.

**Dr Kumar Anandam**

# The animal excreta such as dung, wastes from poultry farms, piggeries and slaughter houses etc. reach the water through run off and surface leaching during rainy season.

#### 4. Thermal Pollution

- o The main sources are the thermal and nuclear power plants.
- o The power plants use water as coolant and release hot waters to the original source.
- o Sudden rise in temperature kills fishes and other aquatic animals.

#### 5. Underground water pollution:

- o In India at many places, the ground water is threatened with contamination due to seepage from industrial and municipal wastes and effluents, sewage channels and agricultural runoff.

#### 6. Marine pollution:

- o Oceans are the ultimate sink of all natural and manmade pollutants.
- o Rivers discharge their pollutants into the sea. The sewerage and garbage of coastal cities are also dumped into the sea.
- o The other sources of oceanic pollution are navigational discharge of oil, grease, detergents, sewage, garbage and radioactive wastes, off shore oil mining, oil spills.

#### 7. Untreated sewage from households:

- o Dye, lotion, soap, hair oil, shampoo, powder, deodorant, moisturizer and many other such products also contribute in water pollution. These products go to the sewage without any treatment.
- o Untreated sewage from households can contaminate different water bodies in the process.
- o When sewage pipes break, there is a chance that the wastes will contaminate drinking water. Sometimes, poorly treated sewage is released into water bodies. Domestic cleaning products can be very dangerous pollutants.

8. Garbage: Plastics are non-biodegradable. Mass plastics clog water bodies and contaminate water.

9. Urbanization: Urbanization is a key factor in increasing the amounts of water pollution.

10. Dumping solid waste: Humans often carelessly dump their trash in the sea or near rivers.

11. Oil spills: Accidental oil spills have a devastating effect on seas.

12. Dissolved gases: Polluting gases in the air can dissolve into salt and fresh water and pollute it.

13. Boat fuels: Fossil fuels used in the shipping industry are one of the largest causes of both air and water pollution.

### **Effects of water pollution**

Water pollution damages human health makes our living conditions precarious and threatens life on the planet.

#### **1. *Effects on aquatic ecosystem:***

- Polluted water reduces Dissolved Oxygen (DO) content, thereby, eliminates sensitive organisms like plankton, molluscs and fish etc.
- Biocides, polychlorinated biphenyls (PCBs) and heavy metals directly eliminate sensitive aquatic organisms.
- Hot waters discharged from industries, when added to water bodies, lowers its DO content.

#### **2. *Effects on human health:***

- The polluted water usually contains pathogens like virus, bacteria, parasitic protozoa and worms; therefore, it is a source of water borne diseases like jaundice, cholera, typhoid, amoebiasis etc.
- Mercury compounds in waste water are converted by bacterial action into extremely toxic methyl mercury, which can cause numbness of limbs, lips and tongue, deafness, blurring of vision and mental derangement.
- Water contaminated with cadmium can cause itai itai disease also called ouch-ouch disease (a painful disease of bones and joints) and cancer of lungs and liver.
- The compounds of lead cause anaemia, headache, loss of muscle power and bluish line around the gum.
- A crippling deformity called Minamata disease due to consumption of fish captured from mercury contaminated Minamata Bay in Japan was detected in 1952.

#### **3. *Hazards of ground water pollution:***

- Presence of excess nitrate in drinking water is dangerous for human health and may be fatal for infants.

**Dr Kumar Anandam**

o Excess nitrate in drinking water reacts with haemoglobin to form non-functional methaemoglobin, and impairs oxygen transport. This condition is called methaemoglobinemia or blue baby syndrome.

• Excess fluoride in drinking water causes neuro- muscular disorders, gastro-intestinal problems, teeth deformity, hardening of bones and stiff and painful joints (skeletal fluorosis).

o High concentration of fluoride ions is present in drinking water in 13 states of India. The maximum level of fluoride, which the human body can tolerate is 1.5 parts per million (mg/1 of water). Long term ingestion of fluoride ions causes fluorosis.

• Over exploitation of ground water may lead to leaching of arsenic from soil and rock sources and contaminate ground water. Chronic exposure to arsenic causes lack foot disease. It also causes. Diarrhoea, Peripheral neuritis, hyperkeratosis and also lung and skin cancer.

o Arsenic contamination is a serious problem (in tube well dug areas) in the Ganges Delta, west Bengal causing serious arsenic poisoning to large numbers of people. A 2007 study found that over 137 million people in more than 70 countries are probably affected by arsenic poisoning of drinking water.

#### 4. ***Biological Magnification***

#### 5. ***Eutrophication***

### **Control Measures**

1) Riparian buffers

2) Recycle

3) Treatment of sewage water and the industrial effluents should be done before releasing it water bodies.

4) Hot water should be cooled before release from the power plants

5) Domestic cleaning in tanks, streams and rivers, which supply drinking water, should be prohibited.

6) Excessive use of fertilizers and pesticides should be avoided.

7) Organic farming and efficient use of animal residues as fertilizers.

8) Water hyacinth (an aquatic weed) can purify water by taking some toxic materials and a number of heavy metals from water.

**Dr Kumar Anandam**

9) Oil spills in water can be cleaned with the help of bregoli a by-product of paper industry resembling saw dust, oil zapper, organisms.

### **Groundwater Pollution**

Any addition of undesirable substances to groundwater caused by human activities is considered to be contamination. It has often been assumed that contaminants left on or under the ground will stay there. This has been shown to be wishful thinking. Groundwater often spreads the effects of dumps and spills far beyond the site of the original contamination. Groundwater contamination is extremely difficult, and sometimes impossible, to clean up.



Groundwater contaminants come from two categories of sources: point sources and distributed, or non-point sources. Landfills, leaking gasoline storage tanks, leaking septic tanks, and accidental spills are examples of point sources. Infiltration from farm land treated with pesticides and fertilizers is an example of a non-point source.

### **Sources of ground water pollution:**

Most concern over groundwater contamination has centred on pollution associated with human activities.

Human groundwater contamination can be related to waste disposal (private sewage disposal systems, land disposal of solid waste, municipal wastewater, wastewater impoundments, land spreading of sludge, brine disposal from the petroleum industry, mine wastes, deep-well disposal of liquid wastes, animal feedlot wastes,

**Dr Kumar Anandam**

Pesticides, fertilizers, herbicides and animal waste are agricultural sources of groundwater contamination

Manufacturing and service industries have high demands for cooling water, processing water and water for cleaning purposes.

Groundwater pollution occurs when used water is returned to the hydrological cycle.

Residential wastewater systems can be a source of many categories of contaminants, including bacteria, viruses, nitrates from human waste, and organic compounds.

***Other sources of ground water pollution:***

1. Storage Tanks

May contain gasoline, oil, chemicals, or other types of liquids and they can either be above or below ground.

2. Septic Systems

Onsite wastewater disposal systems used by homes, offices or other buildings that are not connected to a city sewer system.

3. Uncontrolled Hazardous Waste

Hazardous waste sites can lead to groundwater contamination if there are barrels or other containers lying around that are full of hazardous materials.

4. Landfills

Landfills are the places that our garbage is taken to be buried. Landfills are supposed to have a protective bottom layer to prevent contaminants from getting into the water.

5. Chemicals and Road Salts

The widespread use of chemicals and road salts is another source of potential groundwater contamination. Chemicals include products used on lawns and farm fields to kill weeds and insects and to fertilize plants, and other products used in homes and businesses.

6. Atmospheric Contaminants

Since groundwater is part of the hydrologic cycle, contaminants in other parts of the cycle, such as the atmosphere or bodies of surface water, can eventually be transferred into our groundwater supplies.

***Dangers of contaminated groundwater:***

**On health: -**

**Dr Kumar Anandam**

- ☐ Drinking contaminated groundwater can have serious health effects.
- ☐ Diseases such as hepatitis and dysentery may be caused by contamination from septic tank waste.
- ☐ Poisoning may be caused by toxins that have leached into well water supplies.
- ☐ Wildlife can also be harmed by contaminated groundwater.
- ☐ Other long term effects such as certain types of cancer may also result from exposure to polluted water.

#### **On economy:-**

When groundwater becomes contaminated, the economy can also easily suffer:

- ☐ Depreciating value of land - When groundwater becomes more contaminated in a given area, that area becomes less capable of sustaining human, animal, and plant life. If the area is known for its natural beauty and that nature begins to suffer the effects of pollution, the chances of people wanting to live there decrease even more. Although it might not be an immediate result of groundwater pollution, the depreciation of land value is definitely a potential side effect.
- ☐ Less stable industry - Many industries rely on groundwater to help produce their products and keep their factories running smoothly. Since the pH and quality of groundwater from a given area rarely changes, it becomes a vital part of many industries that rely on water they don't have to constantly test.

#### ***On Environment: -***

Last but certainly not least, the environment can be seriously altered when groundwater is polluted. Here are just some of the ways in which this occurs.

- ☐ Nutrient pollution - Groundwater pollution can cause certain types of nutrients that are necessary in small amounts to become far too abundant to sustain normal life in a given ecosystem. Fish might start dying off quickly because they are no longer able to process the water in their water supplies, and other animals might become sick from too much of certain types of nutrients in the water they drink.
- ☐ Toxic water in ecosystems - When groundwater that supplies lakes, rivers, streams, ponds, and swamps becomes contaminated, this slowly leads to more and more contamination of the surface water as well.

**Conclusion:** Groundwater is one of our most important sources of water for irrigation. Groundwater contamination is a serious problem. Water scarcity puts lives at risk. In addition, many industries rely on water as a resource, which means water contamination threatens their

**Dr Kumar Anandam**

supply chains. Governments, business and communities should all take necessary action to protect this valuable resource.

## **Marine Pollution**

Marine pollution refers to the contamination or presence of pollutants in oceans and seas. The word ‘marine’ comes from the Latin word for ‘sea’ and it is related to similar words, such as ‘mariner’. Ocean pollution is become ever more of a problem in the present day.

Marine pollution can be defined as anything that contaminates the sea. Common marine pollutants include chemicals, small plastic beads in exfoliants and also toxic bio-matter (such as sewage). But, noise – due to excessive traffic around the ocean – can also be defined as pollution if it disrupts marine life.

Pollution can vary depending on the context and the purpose for which seawater is being used. For example, normal seawater has some small particles of plants or sand in, and when the sea is considered as the habitat of marine animals, one would not think of these particles as pollutants whereas one would definitely define toxic chemicals as pollutants. However if somebody wanted to use this brine for cooking in, they might see the sand and plants as polluting our cooking water.

### **Causes/Sources of Marine Pollution**

1. Toxic chemicals in water.

Chemical runoff from industry can really endanger marine life. Industrial waste pumped into the sea, household cleaners poured down the sink, and even chemicals in the atmosphere (for instance due to the discharge of industrial wastes through factory chimneys) that dissolve into the sea can pollute our oceans significantly.

2. Oil spillages.

This is usually an accidental form of industrial dumping, whereby leaks in oil tankers cause vast quantities of oil to pour into the ocean. Accidental oil spills can devastate marine life.

3. Small particles.

The tiny plastic beads in exfoliating creams and other small particles that we pour down the drain without thinking wind up polluting the ocean.

4. Plastic, Litter, and human waste.

**Dr Kumar Anandam**



Plastic bags, aluminum cans, trash and other human waste constitute a major pollutant of the world's oceans. A huge 'island' of trash roughly the size of Texas was recently found in the Pacific ocean for instance, demonstrating the vast scale of this problem.

5. Sewage.

Whether or not it is treated with toxic chemicals, sewage pollutes the clear, clean water of the oceans. This is another type of industrial dumping. Sometimes, sewage is not pumped directly into the sea but into rivers, and then the untreated water of rivers carries it into the sea.

6. The shipping industry.

Gases (which dissolve in the sea), chemicals and sewage from container ships are major pollutants.

7. Dissolved greenhouse gases.

Greenhouse gases from human fossil fuel consumption are making the sea more acidic.

### **Effects of Marine Pollution**

1. Oxygen depletion.

Seawater is full of dissolved oxygen, however decomposing sewage and other biomatter in oceans can result in a condition known as 'hypoxia' or oxygen depletion. This makes it hard for oxygen loving marine life – plants, fish and animals – to survive in the oceans.

2. Higher acidity.

Toxic chemicals make our oceans more acidic. Again, this makes them poisonous to marine life and causes harm to fish and marine mammals as well as marine plants and corals.

3. Choking marine life.

Small pieces of plastic and other litter are increasingly being found in the stomach of fish, turtles and other marine animals. These pieces of trash choke marine animals and hamper their digestion, with an often fatal result.

4. Spoiling birds' feathers.

Oil spills coat the feathers of marine birds and strip them of the natural oils that birds use to keep their feathers waterproof and to maintain their own body temperatures. As a result, marine

birds can overheat or get too cold, and they find it hard to stay afloat as their feathers get soggy. They will also find it difficult to fly when their feathers are clogged with oil.

5. Blocking out the sunlight.

Pollutants such as oil or litter can block out the sunlight from sea plants which need sunlight for photosynthesis.

6. Dangers to human health.

Human swimmers and water sports lovers can become endangered by swimming in a polluted sea.

### **Control Measures/ Solutions for Marine Pollution**

1. Be careful with our chemicals.

Climate change and marine pollution are both results of excess human interference in the natural world. If we choose eco-friendly household cleaners and take measures to reduce the fumes we release into the air (for instance, by choosing public transport over cars) we can reduce the impact of our lives on the oceans.

Further, careful site monitoring to prevent or stop any chemical or oil spills at all times will reduce the instances of oil spills.

2. Don't flush or rinse away harmful particles.

If we do not flush plastics down the toilet, and if we do not pour oils and exfoliating beads down the faucet, we prevent these particles from reaching our oceans. Switch to exfoliants that use natural materials like seeds, sugar or sand instead – and recycle all plastics!

3. Campaign.

Influence the decisions of policymakers and factory bosses to make them more eco-friendly by lobbying, writing letters, spreading the word on social media and campaigning. Motivating the shipping companies to use safe and environmentally friendly vessels are among the key measures that can be taken here.

4. Volunteer at an oil spill site.

Volunteers are always needed at oil spill sites to save the lives of marine birds by washing the oil from their feathers and caring for them until they are ready to fly, swim and dive under water again. Intervention is always needed as soon as possible to ensure that these birds do not suffer any ill effects to their health.

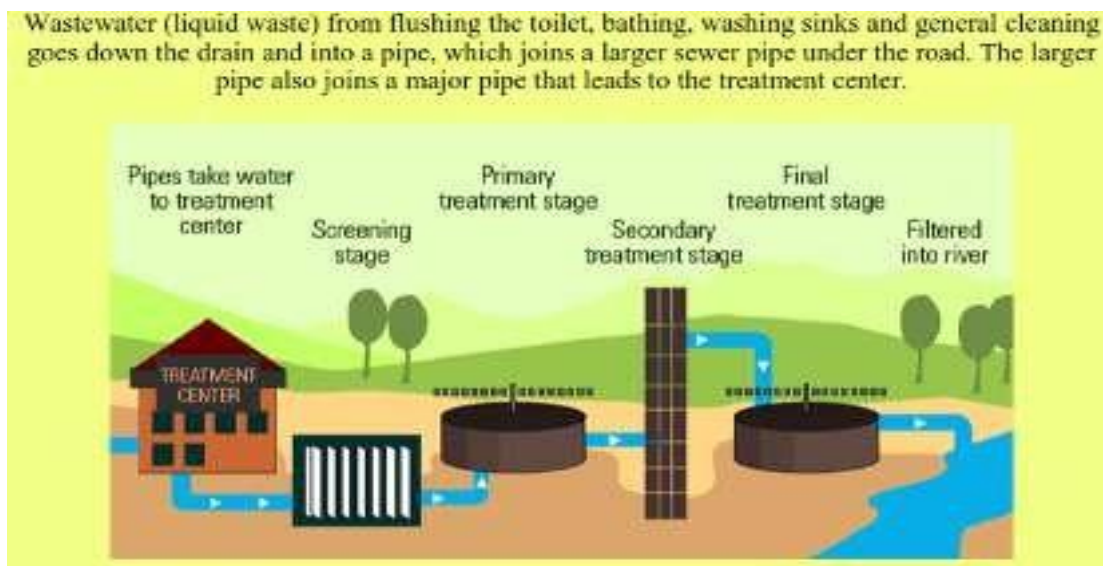
5. Volunteer at a beach cleanup – or organize one yourself.

**Dr Kumar Anandam**

Rid your local beach of litter by getting together with the rest of the community to pick up the trash left behind by careless picnickers, boat crews and more. Joining together as a community to care for the natural world is a wonderful way to remind everyone how intimately we are connected to nature, and how much we depend on it. Working together with other people also helps to keep us motivated and reminds us that we are not alone in our quest to care for the environment.

6. Ensuring no debris is released into the ocean.

Recycling our plastics and other recyclable, and disposing of our waste responsibly is key here. Wastewater treatment before discharge into water bodies:



► **STAGE ONE: SCREENING**

Screening is the first stage of the wastewater treatment process. Screening removes large objects like, diapers, nappies, sanitary items, cotton buds, face wipes and even broken bottles, bottle tops, plastics and rags that may block or damage equipment.

Special equipment is also used to remove grit that gets washed into the sewer.

► **STAGE TWO: PRIMARY TREATMENT**

This involves the separation of organic solid matter (or human waste) from the wastewater. This is done by putting the wastewater into large settlement tanks for the solids to sink to the bottom of the tank. The settled solids are called 'sludge'. At the bottom of these circular tanks, large scrappers continuously scrape the floor of the tank and push the sludge towards the center where it is pumped away for further treatment. The rest of the water is then moved to the Secondary treatment.

► **STAGE THREE: SECONDARY TREATMENT**

The water, at this stage, is put into large rectangular tanks. These are called aeration lanes. Air is pumped into the water to encourage bacteria to break down the tiny bits of sludge that escaped the sludge scraping process.

► **STAGE FOUR: FINAL TREATMENT**

Next, the 'almost' treated wastewater is passed through a settlement tank. Here, more sludge is formed at the bottom of the tank from the settling of the bacterial action. Again, the sludge is scraped and collected for treatment. The water at this stage is almost free from harmful substances and chemicals. The water is allowed to flow over a wall where it is filtered through a bed of sand to remove any additional particles.

The filtered water is then released into the river.

## **Conclusion**

Marine pollution is a serious issue, and it comes in many forms. Nevertheless, there are several ways that we can take positive action right now to solve this problem of marine pollution. We should never think that our individual actions do not count when it comes to caring for the environment: they do! If we refrained from dumping rubbish in the ocean, for instance, every single individual on this earth could prevent several tonnes of trash from spoiling the habitats of marine animals – this is no small achievement! And, when we club together with other people, our ability to fight marine pollution becomes even bigger. So why not start today? Write to your local authority, organize a beach cleanup, research environmentally friendly household cleaning products and stop using exfoliating products containing plastic beads. You could save a life in the sea today!

**Dr Kumar Anandam**