Water Pollution CBCS: ENVS: S Maiti>28.9.21

Water pollution is the contamination of water sources by substances which make the water unusable for drinking, cooking, cleaning, swimming, and other activities. Pollutants include chemicals, trash, bacteria, and parasites. All forms of pollution eventually make their way to water. Air pollution settles onto lakes and oceans. Land pollution can seep into an underground stream, then to a river, and finally to the ocean. Thus, waste dumped in a vacant lot can eventually pollute a water supply.

Water pollutants may cause disease or act as poisons. Bacteria and parasites in poorly treated sewage may enter drinking water supplies and cause digestive problems such as cholera and diarrhea. Hazardous chemicals, pesticides, and herbicides from industries, farms, homes and golf courses can cause acute toxicity and immediate death, or chronic toxicity that can lead to neurological problems or cancers. Many water pollutants enter our bodies when we use water for drinking and food preparation. The pollutants enter the digestive tract. From there, they can reach other organs in the body and cause various illnesses. Chemicals come in contact with the skin from washing clothes, or from swimming in polluted water and may lead to skin irritations. Hazardous chemicals in water systems can also affect the animals and plants which live there. Sometimes these organisms will survive with the chemicals in their systems, only to be eaten by humans who may then become mildly ill or develop stronger toxic symptoms. The animals and plants themselves may die or not reproduce properly.

Use less water: Clean, fresh water may seem plentiful, but there is a limited amount available on earth. Use water-saving devices on sinks, in toilets, and in showers. Take short showers instead of baths. Do not run the water constantly while brushing your teeth. Wash clothes when you have a full load of laundry. Only water your lawn and plants when absolutely necessary.

Avoid pouring chemicals down the drain: Use fewer chemicals and cleaners around the home. Not only will you cut down on indoor air pollution, but also on the amount of chemicals entering the water system. If necessary, use biodegradable cleaners. Do not pour oil or other chemicals into the drainage system on the street.

Have your water checked for lead contamination: Many homes have lead pipes or lead around connections on the pipes which carry water to their homes. Since this lead may enter your drinking water and cause medical problems in young children, you might want to have the water tested. If lead is present, installing a filter may solve the problem.

Do not pollute outdoor water sources: Do not pour oil or other chemicals into the drainage system on the street. A little oil can kill many plants and animals. Do not litter, especially near water. Litter may be eaten as food by animals and cause harm to them. Do not use pesticides on lawns, or use only organic ones. Use less fertilizer, also. All these can enter our water sources.

Enjoy water for eating, drinking, cleaning, swimming, etc. Just remember to use it carefully. Do not waste or pollute this limited precious resource.

Central Pollution Control Board
Ministry of Environment, Forest and Climate Change
Government of India

The Water (Prevention and Control of Pollution) Act was enacted in 1974 to provide for the prevention and control of water pollution, and for the maintaining or restoring of wholesomeness of water in the country. The Act was amended in 1988. The Water (Prevention and Control of Pollution) Cess Act was enacted in 1977, to provide for the levy and collection of a cess on water consumed by persons operating and carrying on certain types of industrial activities. This cess is collected with a view to augment the resources of the Central Board and the State Boards for the prevention and control of water pollution constituted under the Water (Prevention and Control of Pollution) Act, 1974. The Act was last amended in 2003.

Acts

- No.06 of 1974, [23/03/1974] - The Water (Prevention and Control of Pollution) Act, 1974 ,
- The Water (Prevention and Control of Pollution) Cess Act, 1977 ,

Rules

- G.S.R.221(E), [23/03/2015] - Central Pollution Control Board (Qualifications and Terms and Conditions of Service of Chairman) Rules, 2015
- G.S.R.860(E), [30/11/2012] - The Central Pollution Control Board (Qualifications and other Terms and Conditions of Service of Chairman) (Amendment) Rules, 2012.

Popular activist on Environmental protection and climate issues

Greta Tintin Eleonora Ernman Thunberg (Swedish: [ˈgrêːta ˈtûːnbærj] (listen); born 3 January 2003) is a Swedish environmental activist who is known for challenging world leaders to take immediate action for climate change mitigation. Thunberg initially gained notice for her youth and her straightforward speaking manner, both in public and to political leaders and assemblies, in which she criticises world leaders for their failure to take what she considers sufficient action to address the climate crisis.

After Thunberg addressed the 2018 United Nations Climate Change Conference, student strikes took place every week somewhere in the world. In 2019, there were multiple coordinated multi-city protests involving over a million students each. To avoid energy-intensive flying, Thunberg sailed to North America where she attended the 2019 UN Climate Action Summit.

Leonardo DiCaprio

The actor is a ferocious environmental activist. One example is the foundation he set up in 1998 that bears his name: The Leonardo DiCaprio Foundation. It runs more than 35 conservation projects and its mission is to protect Earth's last remaining wild places and apply sustainable solutions to encourage a healthier relationship between humankind and nature. What's more, he has also produced several documentaries on these concerns.

Inger Andersen

At a crucial time for the planet's future, this Danish economist and ecologist is leading the UN fight against climate change **in her position as** executive director of the UN Environment Programme (UNEP). After more than 30 years working in developing economics, environmental sustainability and policymaking, she has two more crises to deal with which are related to climate change: Pollution and biodiversity loss.

William Nordhaus

Known as the father of the climate change economy, he received the Nobel Prize in 2018 for his climate and economic models, designed to consider **the potentially catastrophic impact of climate change on the economy.** He has been working in this area for decades, publishing his first work on the subject in 1994, entitled, Managing the Global Commons: The Economics of Climate Change, which he followed with others, like Warming the World: Economic Models of Global Warming (2000) and A Question of Balance: Weighing the Options on Global Warming Policies (2008).

Water pollution (or **aquatic pollution**) is the contamination of water bodies, usually as a result of human activities and by natural processes also.

Water pollution reduces the ability of the body of water to provide the ecosystem services that it would otherwise provide. Water bodies include for example lakes, rivers, oceans, aquifers, reservoirs and groundwater. Water pollution results when contaminants are introduced into these water bodies. For example, releasing inadequately treated wastewater into natural waters can lead to degradation of these aquatic ecosystems.

The effects can damage individual species and impact the natural biological communities they are part of. Water pollution can also lead to water-borne diseases for people using polluted water for drinking, bathing, washing or irrigation.

Water pollution can be classified as:

surface water pollution (for example lakes, streams, estuaries, and parts of the ocean in marine pollution) or groundwater pollution.

Sources of water pollution are either point sources or non-point sources. Point sources have one identifiable cause, such as a storm drain or a wastewater treatment plant. Non-point sources are more diffuse, such as agricultural runoff.

Pollution may take the form of toxic substances: (e.g., oil, metals, plastics, pesticides, persistent organic pollutants, industrial waste products), stressful conditions (e.g., changes of pH, hypoxia or anoxia, stressful temperatures, excessive turbidity, unpleasant taste or odor, and changes of salinity), or pathogenic organisms. Contaminants may include organic and inorganic substances. Heat can also be a pollutant, and this is called thermal pollution. A common cause of thermal pollution is the use of water as a coolant by power plants and industrial manufacturers.

Water pollution is measured by analyzing water samples and testing for a range of physical, chemical and biological parameters. Control of water pollution requires appropriate infrastructure and management plans as well as legislation. Technology solutions can include improving sanitation, sewage treatment, industrial wastewater treatment, agricultural wastewater treatment, erosion control, sediment control and control of urban runoff (including stormwater management). Effective control of urban runoff includes reducing speed and quantity of flow.

Water is typically referred to as polluted when it is impaired by anthropogenic contaminants. Due to these contaminants it either does not support a human use, such as drinking water, or undergoes a marked shift in its ability to support its biotic communities, such as fish.

Impacts

Ecosystems

Water pollution is a major global environmental problem because it can result in the degradation of aquatic ecosystems. The specific contaminants leading to pollution in water include a wide spectrum of chemicals, pathogens, and physical changes such as elevated temperature. While many of the chemicals and substances that are regulated may be naturally occurring (calcium, sodium, iron, manganese, etc.) the concentration usually determines what is a natural component of water and what is a contaminant. High concentrations of naturally occurring substances can have negative impacts on aquatic flora and fauna. Oxygen-depleting substances may be natural materials such as plant matter (e.g. leaves and grass) as well as man-made chemicals. Other natural and anthropogenic substances may cause turbidity (cloudiness) which blocks light and disrupts plant growth, and clogs the gills of some fish species.

There is concern that water pollution can damage phytoplankton in the oceans who produce 70% of oxygen and remove a large part of carbon dioxide from the atmosphere.

Public health and waterborne diseases

A study published in 2017 stated that "polluted water spread gastrointestinal diseases and parasitic infections and killed 1.8 million people" (these are also referred to as waterborne diseases).

Eutrophication from nitrogen pollution

Nitrogen pollution (a form of water pollution where excessive amounts of nutrients are added to a water body), can cause eutrophication, especially in lakes. Eutrophication is an increase in the concentration of chemical nutrients in an ecosystem to an extent that increases the primary productivity of the ecosystem. Depending on the degree of eutrophication, subsequent negative environmental effects such as anoxia (oxygen depletion) and severe reductions in water quality may occur, affecting fish and other animal populations.

Ocean acidification

Ocean acidification is another impact of water pollution.

This section is an excerpt from Ocean acidification.
Ocean acidification is the ongoing decrease in the pH value of the Earth's oceans, caused by the uptake of carbon dioxide (CO_2) from the atmosphere.

Contaminants and their sources

Overview

If the water pollution stems from sewage (municipal wastewater), the main pollutants are: suspended solids, biodegradable organic matter, nutrients and pathogenic organisms.

Pollutants and their effects (sources of these pollutants are municipal and industrial wastewater, urban runoff, agricultural and pasture activities). Adapted from.

Pollutant	Main representative parameter	Possible effect of the pollutant
Suspended solids	Total suspended solids	• Aesthetic problems • Sludge deposits • Pollutants adsorption • Protection of pathogens
Biodegradable organic matter	Biological oxygen demand	• Oxygen consumption • Death of fish • Septic conditions
Nutrients	• Nitrogen • Phosphorus	• Excessive algae growth • Toxicity to fish (ammonia) • Illnesses in new-born infants (Blue baby syndrome from nitrate) • Pollution of groundwater
Pathogens	• Coliforms, such as E. Coli	Waterborne diseases

	• Helminth eggs	
Non-biodegradable organic matter	• Pesticides • Some detergents • Others	• Toxicity (various) • Foam (detergents) • Reduction of oxygen transfer (detergents) • Non-biodegradability • Bad odors (e.g.: phenols)
Inorganic dissolved solids	• Total dissolved solids • Conductivity	• Excessive salinity – harm to plantations (irrigation) • Toxicity to plants (some ions) • Problems with soil permeability (sodium)

Pathogens from sewage and agriculture

Further information: Waterborne diseases § Diseases by type of pathogen, and Sewage § Pathogens

Poster to teach people in South Asia about human activities leading to the pollution of water sources

Disease-causing microorganisms are referred to as pathogens. The major groups of pathogenic organisms are: (a) bacteria, (b) viruses, (c) protozoans and (d) helminths. In practice, indicator organisms are used to investigate pathogenic pollution of water because the detection of pathogenic organisms in water sample is difficult and costly, because of their low concentrations. The indicators (bacterial indicator) of fecal contamination of water samples most commonly used are: total coliforms (TC), fecal coliforms (FC) or thermotolerant coliforms, escherichia coli (EC).

Non-biodegradable organic compounds

Contaminants may include non-biodegradable organic substances. Many of these chemical substances are toxic.

A garbage collection boom to reduce pollution in an urban stream in Auckland, New Zealand.

- Creosote - a chemical used for wood preservation, can be released into the ocean over time
- Chemicals from insecticides and herbicides.
- Petroleum hydrocarbons, including fuels (gasoline, diesel fuel, jet fuels, and fuel oil) and lubricants (motor oil), and fuel combustion byproducts, from oil spills or storm water runoff

- Volatile organic compounds, such as industrial solvents, from improper storage.
- Persistent organic pollutants, for example per- and polyfluoroalkyl substances (PFAS), organochlorides, polychlorinated biphenyl (PCBs), trichloroethylene, perchlorate (these are currently or were in the past used as pesticides, solvents, pharmaceuticals, and industrial chemicals).

Persistent organic pollutant

This section is an excerpt from Persistent organic pollutant.

Persistent organic pollutants (POPs), sometimes known as "forever chemicals" are organic compounds that are resistant to environmental degradation through chemical, biological, and photolytic processes.[29] It is a toxic chemical that adversely affect human health and the environment around the world. Because they can be transported by wind and water, most POPs generated in one country can and do affect people and wildlife far from where they are used and released.

Environmental persistent pharmaceutical pollutants

Water pollution due to environmental persistent pharmaceutical pollutants can have wide-ranging consequences:

This section is an excerpt from Environmental impact of pharmaceuticals and personal care products.

The environmental effect of pharmaceuticals and personal care products (PPCPs) is being investigated since at least the 1990s. PPCPs include substances used by individuals for personal health or cosmetic reasons and the products used by agribusiness to boost growth or health of livestock. More than twenty million tons of PPCPs are produced every year. The European Union has declared pharmaceutical residues with the potential of contamination of water and soil to be "priority substances".

Inorganic contaminants

Inorganic water pollutants include for example:

- Acidity caused by industrial discharges (especially sulfur dioxide from power plants) or by increased carbon dioxide concentrations in the atmosphere (see also ocean acidification). In industrialized areas, acid rain has in the past resulted in pollution of lakes and rivers due to air pollution with dissolved oxides of sulfur and nitrogen.[*citation needed*]
- Ammonia from food processing waste
- Heavy metals from motor vehicles (via urban storm water runoff) and acid mine drainage
- Nitrates and phosphates, from sewage and agriculture (see nutrient pollution)
- Silt (sediment) in runoff from construction sites or sewage, logging, slash and burn practices or land clearing sites.

Contaminants from industrial wastewater

If the pollution stems from industrial wastewater, then pollutants may include:

This section is an excerpt from Industrial wastewater treatment § Pollutants.

> This section **may contain content that is repetitive or redundant of text elsewhere in the article**. Please help improve it by merging similar text or removing repeated statements. *(September 2021)*

The composition of industrial wastewater varies widely. This is a partial list of chemical or physical pollutants that may be contained in industrial wastewater:

- Heavy metals, including mercury, lead, and chromium
- Organic matter such as food waste, slaughterhouse waste, paper fibers, plant material, etc.;
- Inorganic particles such as sand, grit, metal particles, rubber residues from tires, ceramics, etc.;
- Toxins such as pesticides, poisons, herbicides, etc.
- Pharmaceuticals, endocrine disrupting compounds, hormones, perfluorinated compounds, siloxanes, drugs of abuse and other hazardous substances
- Microplastics such as polyethylene and polypropylene beads, polyester and polyamide
- Thermal pollution from power stations and industrial manufacturers
- Radionuclides from uranium mining, processing nuclear fuel, operating nuclear reactors, or disposal of radioactive waste.

Solid waste and plastics

Further information: Sewage § Solid waste, and Plastic pollution

Solid waste can enter water bodies through untreated sewage, combined sewer overflows, urban runoff, people discarding garbage into the environment, wind carrying municipal solid waste from landfills and so forth. This results in macroscopic pollution– large visible items polluting the water– but also microplastics pollution that is not directly visible. The term marine debris is used in the context of pollution of oceans.

Thermal pollution

The Brayton Point Power Station in Massachusetts discharges heated water to Mount Hope Bay.
This section is an excerpt from Thermal pollution.
Thermal pollution, sometimes called "thermal enrichment," is the degradation of water quality by any process that changes ambient water temperature. Thermal pollution is the rise or fall in the temperature of a natural body of water caused by human influence. Thermal pollution, unlike chemical pollution, results in a change in the physical properties of water. A common cause of thermal pollution is the use of water as a coolant by power plants and industrial manufacturers. Urban runoff—stormwater discharged to surface waters from rooftops, roads and parking lots—

and reservoirs can also be a source of thermal pollution. Thermal pollution can also be caused by the release of very cold water from the base of reservoirs into warmer rivers.

Elevated water temperatures decrease oxygen levels (due to lower levels of dissolved oxygen, as gases are less soluble in warmer liquids), which can kill fish (which may then rot) and alter food chain composition, reduce species biodiversity, and foster invasion by new thermophilic species.

Oil spills

This section is an excerpt from Oil spill.
An oil spill is the release of a liquid petroleum hydrocarbon into the environment, especially the marine ecosystem, due to human activity, and is a form of pollution. The term is usually given to marine oil spills, where oil is released into the ocean or coastal waters, but spills may also occur on land. Oil spills may be due to releases of crude oil from tankers, offshore platforms, drilling rigs and wells, as well as spills of refined petroleum products (such as gasoline, diesel) and their by-products, heavier fuels used by large ships such as bunker fuel, or the spill of any oily refuse or waste oil.

Others

The introduction of aquatic invasive organisms is a form of water pollution as well. It causes biological pollution.

Groundwater pollution

This section is an excerpt from Groundwater pollution.

Groundwater pollution (also called groundwater contamination) occurs when pollutants are released to the ground and make their way into groundwater. This type of water pollution can also occur naturally due to the presence of a minor and unwanted constituent, contaminant, or impurity in the groundwater, in which case it is more likely referred to as contamination rather than pollution. Pollution can occur from on-site sanitation systems, landfills, effluent from wastewater treatment plants, leaking sewers, petrol filling stations or from over application of fertilizers in agriculture. Pollution (or contamination) can also occur from naturally occurring contaminants, such as arsenic or fluoride.[70] Using polluted groundwater causes hazards to public health through poisoning or the spread of disease (water-borne diseases).

Biological testing

The use of a biomonitor is described as biological monitoring. This refers to the measurement of specific properties of an organism to obtain information on the surrounding physical and chemical environment. Biological testing involves the use of plant, animal or microbial indicators to monitor the health of an aquatic ecosystem. They are any biological species or group of species whose function, population, or status can reveal what degree of ecosystem or environmental integrity is present. One example of a group of bio-indicators are the copepods

and other small water crustaceans that are present in many water bodies. Such organisms can be monitored for changes (biochemical, physiological, or behavioral) that may indicate a problem within their ecosystem.

Pollution control

Moving towards a holistic approach in chemical pollution control combines the following approaches: Integrated control measures, trans-boundary considerations, complementary and supplementary control measures, life-cycle considerations, the impacts of chemical mixtures.

Control of water pollution requires appropriate infrastructure and management plans. The infrastructure may include wastewater treatment plants, for example sewage treatment plants and industrial wastewater treatment plants. Agricultural wastewater treatment for farms, and erosion control at construction sites can also help prevent water pollution. Effective control of urban runoff includes reducing speed and quantity of flow.

Water pollution requires ongoing evaluation and revision of water resource policy at all levels (international down to individual aquifers and wells).

Sanitation and sewage treatment

Fecal sludge collected from pit latrines is dumped into a river at the Korogocho slum in Nairobi, Kenya.
Further information: Sanitation, WASH, and Water issues in developing countries

Municipal wastewater (or sewage) can be treated by centralized sewage treatment plants, decentralized wastewater systems, nature-based solutions or in onsite sewage facilities and septic tanks.

Industrial wastewater treatment

This section is an excerpt from Industrial wastewater treatment.
Industrial wastewater treatment describes the processes used for treating wastewater that is produced by industries as an undesirable by-product. After treatment, the treated industrial wastewater (or effluent) may be reused or released to a sanitary sewer or to a surface water in the environment.

Agricultural wastewater treatment

Anaerobic lagoon for treatment of dairy wastes

Agricultural wastewater treatment is a farm management agenda for controlling pollution from confined animal operations and from surface runoff that may be contaminated by chemicals in fertilizer, pesticides, animal slurry, crop residues or irrigation water. Agricultural wastewater treatment is required for continuous confined animal operations like milk and egg production. It

may be performed in plants using mechanized treatment units similar to those used for industrial wastewater. Where land is available for ponds, settling basins and facultative lagoons may have lower operational costs for seasonal use conditions from breeding or harvest cycles. Animal slurries are usually treated by containment in anaerobic lagoons before disposal by spray or trickle application to grassland. Constructed wetlands are sometimes used to facilitate treatment of animal wastes.

Control of urban runoff (storm water)

This section is an excerpt from Urban runoff Prevention and mitigation.

Effective control of urban runoff involves reducing the velocity and flow of storm water, as well as reducing pollutant discharges. Local governments use a variety of storm water management techniques to reduce the effects of urban runoff. These techniques, called best management practices for water pollution (BMPs) in some countries, may focus on water quantity control, while others focus on improving water quality, and some perform both functions.

Legislation

Some examples for legislation to control water pollution are listed below:

- In the Philippines, Republic Act 9275, otherwise known as the Philippine Clean Water Act of 2004, is the governing law on wastewater management. It states that it is the country's policy to protect, preserve and revive the quality of its fresh, brackish and marine waters, for which wastewater management plays a particular role.
- The Clean Water Act is the primary federal law in the United States governing water pollution in surface waters. It is implemented by the U.S. Environmental Protection Agency in collaboration with states, territories, and tribes. Groundwater protection provisions are included in the Safe Drinking Water Act, Resource Conservation and Recovery Act, and the Superfund act.