**COURSE : DISASTER MANAGEMENT (MA/ MSc PART I)**
**Paper : III**
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**Topic : Water Pollution**

**INTRODUCTION**

Water pollution occurs when harmful substances—often chemicals or microorganisms—contaminate a stream, river, lake, ocean, aquifer, or other body of water, degrading water quality and rendering it toxic to humans or the environment.

Water is uniquely vulnerable to pollution. Known as a “universal solvent,” water is able to dissolve more substances than any other liquid on earth. It’s the reason we have Kool-Aid and brilliant blue waterfalls. It’s also why water is so easily polluted. Toxic substances from farms, towns, and factories readily dissolve into and mix with it, causing water pollution.

**Categories of Water Pollution**

1. Groundwater Pollution

When rain falls and seeps deep into the earth, filling the cracks, crevices, and porous spaces of an aquifer (basically an underground storehouse of water), it becomes groundwater—one of our least visible but most important natural resources. [Nearly 40 percent of Americans](http://www.ngwa.org/Fundamentals/Documents/usa-groundwater-use-fact-sheet.pdf) rely on groundwater, pumped to the earth’s surface, for drinking water. For some folks in rural areas, it’s their only freshwater source. Groundwater gets polluted when contaminants—from pesticides and fertilizers to waste leached from landfills and septic systems—make their way into an aquifer, rendering it unsafe for human use. Ridding groundwater of contaminants can be difficult to impossible, as well as costly. Once polluted, an aquifer may be unusable for decades, or even thousands of years. Groundwater can also spread contamination far from the original polluting source as it seeps into streams, lakes, and oceans.

1. Surface water Pollution

Covering about [70 percent of the earth](https://water.usgs.gov/edu/earthhowmuch.html), surface water is what fills our oceans, lakes, rivers, and all those other blue bits on the world map. Surface water from freshwater sources (that is, from sources other than the ocean) accounts for [more than 60 percent](https://pubs.usgs.gov/of/2017/1131/ofr20171131.pdf) of the water delivered to American homes. But a significant pool of that water is in peril. According to the most recent surveys on national water quality from the U.S. Environmental Protection Agency, [nearly half of our rivers and streams](https://www.epa.gov/sites/production/files/2016-03/documents/fact_sheet_draft_variation_march_2016_revision.pdf) and [more than one-third of our lakes](https://www.epa.gov/sites/production/files/2016-12/documents/nla_fact_sheet_dec_7_2016.pdf) are polluted and unfit for swimming, fishing, and drinking. [Nutrient pollution](https://www.epa.gov/sites/production/files/2015-03/documents/facts_about_nutrient_pollution_what_is_hypoxia.pdf), which includes nitrates and phosphates, is the leading type of contamination in these freshwater sources. While plants and animals need these nutrients to grow, they have become a [major pollutant](https://www.nrdc.org/stories/whats-your-drinking-water) due to farm waste and fertilizer runoff. Municipal and industrial waste discharges contribute their fair share of toxins as well. There’s also all the random junk that industry and individuals dump directly into waterways.

1. Ocean water pollution

[Eighty percent](https://oceanservice.noaa.gov/facts/pollution.html) of [ocean pollution](https://www.nrdc.org/stories/ocean-pollution-dirty-facts) (also called marine pollution) originates on land—whether along the coast or far inland. Contaminants such as chemicals, nutrients, and heavy metals are carried from farms, factories, and cities by streams and rivers into our bays and estuaries; from there they travel out to sea. Meanwhile, marine debris—[particularly plastic](https://www.nrdc.org/stories/10-ways-reduce-plastic-pollution)—is blown in by the wind or washed in via storm drains and sewers. Our seas are also sometimes spoiled by oil spills and leaks—[big](https://www.mnn.com/earth-matters/wilderness-resources/stories/the-13-largest-oil-spills-in-history) and [small](https://www.wired.com/2016/12/thousands-invisible-oil-spills-destroying-gulf/)—and are consistently soaking up carbon pollution from the air. The ocean absorbs as much as [a quarter of man-made carbon emissions](https://www.nrdc.org/stories/acid-seas).

Types of Water Contamination

A. Agricultural

Not only is the agricultural sector the biggest consumer of global freshwater resources, with farming and livestock production using about [70 percent of the earth’s surface water supplies](http://www.fao.org/docrep/w2598e/w2598e04.htm), but it’s also a serious water polluter. Around the world, agriculture is the [leading cause](http://www.fao.org/3/a-i7754e.pdf) of water degradation. In the United States, agricultural pollution is the [top source of contamination](https://ofmpub.epa.gov/waters10/attains_nation_cy.control#total_assessed_waters) in rivers and streams, the second-biggest source in wetlands, and the third main source in lakes. It’s also a major contributor of contamination to estuaries and groundwater. Every time it rains, fertilizers, pesticides, and animal waste from farms and [livestock operations](https://www.epa.gov/enforcement/national-enforcement-initiative-preventing-animal-waste-contaminating-surface-and-ground) wash nutrients and pathogens—such bacteria and viruses—into our waterways. [Nutrient pollution](https://www.nrdc.org/experts/ben-chou/water-pollution-grows-healthy-soil-comes-rescue), caused by excess nitrogen and phosphorus in water or air, is the number-one threat to water quality worldwide and can [cause algal blooms](https://www.nrdc.org/experts/ben-chou/water-pollution-grows-healthy-soil-comes-rescue), a toxic soup of blue-green algae that can be harmful to people and wildlife.

B. Sewage and wastewater

Used water is wastewater. It comes from our sinks, showers, and toilets (think sewage) and from commercial, industrial, and agricultural activities (think metals, solvents, and toxic sludge). The term also includes [stormwater runoff](https://www.nrdc.org/stories/when-it-rains-it-pours-raw-sewage-new-york-citys-waterways), which occurs when rainfall carries road salts, oil, grease, chemicals, and debris from impermeable surfaces into our waterways

[More than 80 percent of the world’s wastewater](http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/wwdr/2017-wastewater-the-untapped-resource/) flows back into the environment without being treated or reused, according to the United Nations; in some least-developed countries, the figure tops 95 percent. In the United States, wastewater treatment facilities process about [34 billion gallons of wastewater per day](https://www.epa.gov/nutrientpollution/sources-and-solutions-wastewater). These facilities reduce the amount of pollutants such as pathogens, phosphorus, and nitrogen in sewage, as well as heavy metals and toxic chemicals in industrial waste, before discharging the treated waters back into waterways. That’s when all goes well. But according to [EPA estimates](https://www.epa.gov/npdes/2004-npdes-cso-report-congress), our nation’s [aging and easily overwhelmed sewage treatment systems](https://www.nrdc.org/sites/default/files/ttw2014_Sources_of_Beach_Pollution.pdf) also release more than 850 billion gallons of untreated wastewater each year.

C. Oil pollution

Big spills may dominate headlines, but consumers account for the vast majority of oil pollution in our seas, including oil and gasoline that drips from millions of cars and trucks every day. Moreover, nearly half of the [estimated 1 million tons of oil](https://worldoceanreview.com/en/wor-3/oil-and-gas/oiling-the-oceans/?ivt=1#ivt-101) that makes its way into marine environments each year comes not from tanker spills but from land-based sources such as factories, farms, and cities. At sea, tanker spills account for about 10 percent of the oil in waters around the world, while regular operations of the shipping industry—through both [legal](http://www.imo.org/en/OurWork/Environment/PollutionPrevention/OilPollution/Pages/Default.aspx) and [illegal](https://www.justice.gov/opa/pr/greek-shipping-companies-sentenced-pay-27-million-ocean-pollution) discharges—contribute about one-third. Oil is also [naturally released](https://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/resources/what-are-natural-oil-seeps.html) from under the ocean floor through fractures known as seeps.

D. Radioactive substances

[Radioactive waste](https://www.nrdc.org/stories/whats-your-drinking-water) is any pollution that emits radiation beyond what is naturally released by the environment. It’s generated by uranium mining, nuclear power plants, and the production and testing of military weapons, as well as by universities and hospitals that use radioactive materials for research and medicine. Radioactive waste can persist in the environment for thousands of years, making disposal a major challenge. Consider the [decommissioned Hanford nuclear weapons production site](https://thebulletin.org/predictable-nuclear-accident-hanford10774) in Washington, where the cleanup of 56 million gallons of radioactive waste is expected to cost more than $100 billion and last through 2060. [Accidentally released](http://www.stltoday.com/news/local/illinois/investigation-radioactive-leaks-at-illinois-nuclear-plants/article_5afd12ac-e54b-5b20-be98-b72233c1075c.html) or [improperly disposed of](https://www.nrdc.org/experts/geoffrey-h-fettus/final-resting-place-nuclear-waste)contaminants threaten groundwater, surface water, and marine resources.