

# Water Pollution

- Pollution: Degradation of water quality, how far it departs from the norm (standard), its effects on public health or its ecological impacts.
- Pollutant: Biological, physical or chemical substance that in identifiable excess is known to be harmful. Exp.: Excessive amounts of heavy metals, certain radioactive isotopes, fecal coliform bacteria, phosphorous, nitrogen, sodium, certain pathogenic bacteria and viruses.

# Sources of Water Pollution

- *Surface Water:* Urban runoff, Agricultural runoff, Accidental spills of chemicals including oil, Radio active materials, Runoff from industrial sites, Leaks from surface storage tanks, Sediment from various source, Air fallout into rivers, lakes etc.
- *Groundwater:* Leaks from waste disposal sites, buried tanks and pipes, Seepage from agricultural activities, acid rich water from mines, septic systems, pesticides, herbicide nutrients, accidental spills and Salt water intrusion

# Sources of Water Pollution

**TABLE 20.1** Some Sources of Water Pollution

## *Surface Water*

- Urban runoff (oil, chemicals, organic matter, etc.) (U, I, M)
- Agricultural runoff (oil, metals, fertilizers, pesticides, etc.) (A)
- Accidental spills of chemicals including oil (U, R, I, A, M)
- Radioactive materials (often involving truck or train accidents) (I, M)
- Runoff (solvents, chemicals, etc.) from industrial sites (factories, refineries, mines, etc.) (I, M)
- Leaks from surface storage tanks or pipelines (gasoline, oil, etc.) (I, A, M)
- Sediment from a variety of sources, including agricultural lands and construction sites (U, R, I, A, M)
- Air fallout (particles, pesticides, metals, etc.) into rivers, lakes, oceans (U, R, I, A, M)

## *Groundwater*

- Leaks from waste disposal sites (chemicals, radioactive materials, etc.) (I, M)
- Leaks from buried tanks and pipes (gasoline, oil, etc.) (I, A, M)
- Seepage from agricultural activities (nitrates, heavy metals, pesticides, herbicides, etc.) (A)
- Saltwater intrusion into coastal aquifers (U, R, I, M)
- Seepage from cesspools and septic systems (R)
- Seepage of acid-rich water from mines (I)
- Seepage from mine waste piles (I)
- Seepage of pesticides, herbicide nutrients, and so on from urban areas (U)
- Seepage from accidental spills (train or truck accidents, for example) (I, M)
- Inadvertent seepage of solvents and other chemicals including radioactive materials from industrial sites or small businesses (I, M)

Key: U = urban; R = rural; I = industrial; A = agricultural; M = military.

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# Categories of Water Pollutants

- Dead organic matter
- Pathogens
- Organic chemicals
- Nutrients
- Heavy metals
- Acids
- Sediments
- Heat
- Radioactivity



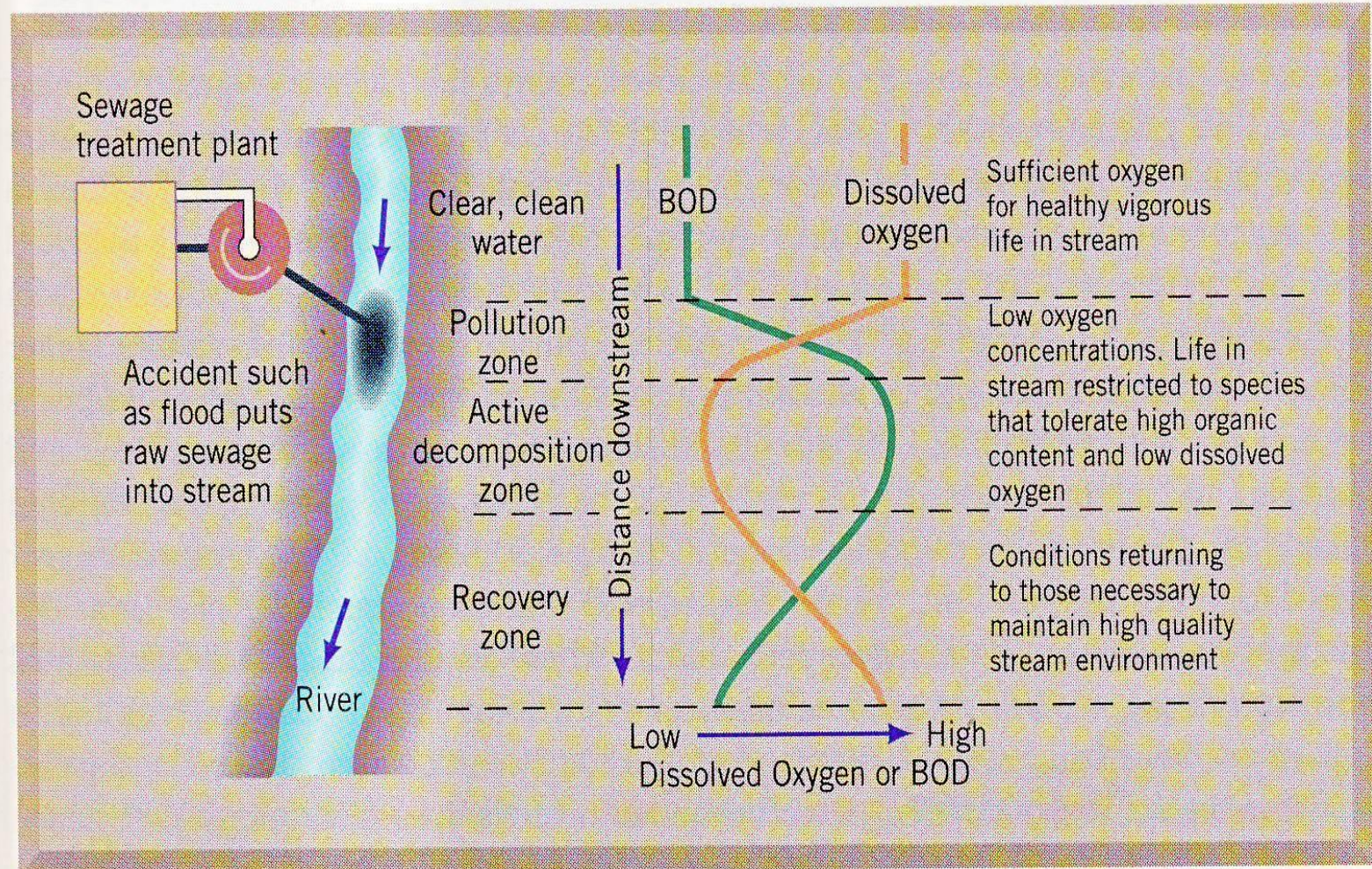
# Categories of Water Pollution

**TABLE 20.2** Categories of Water Pollutants

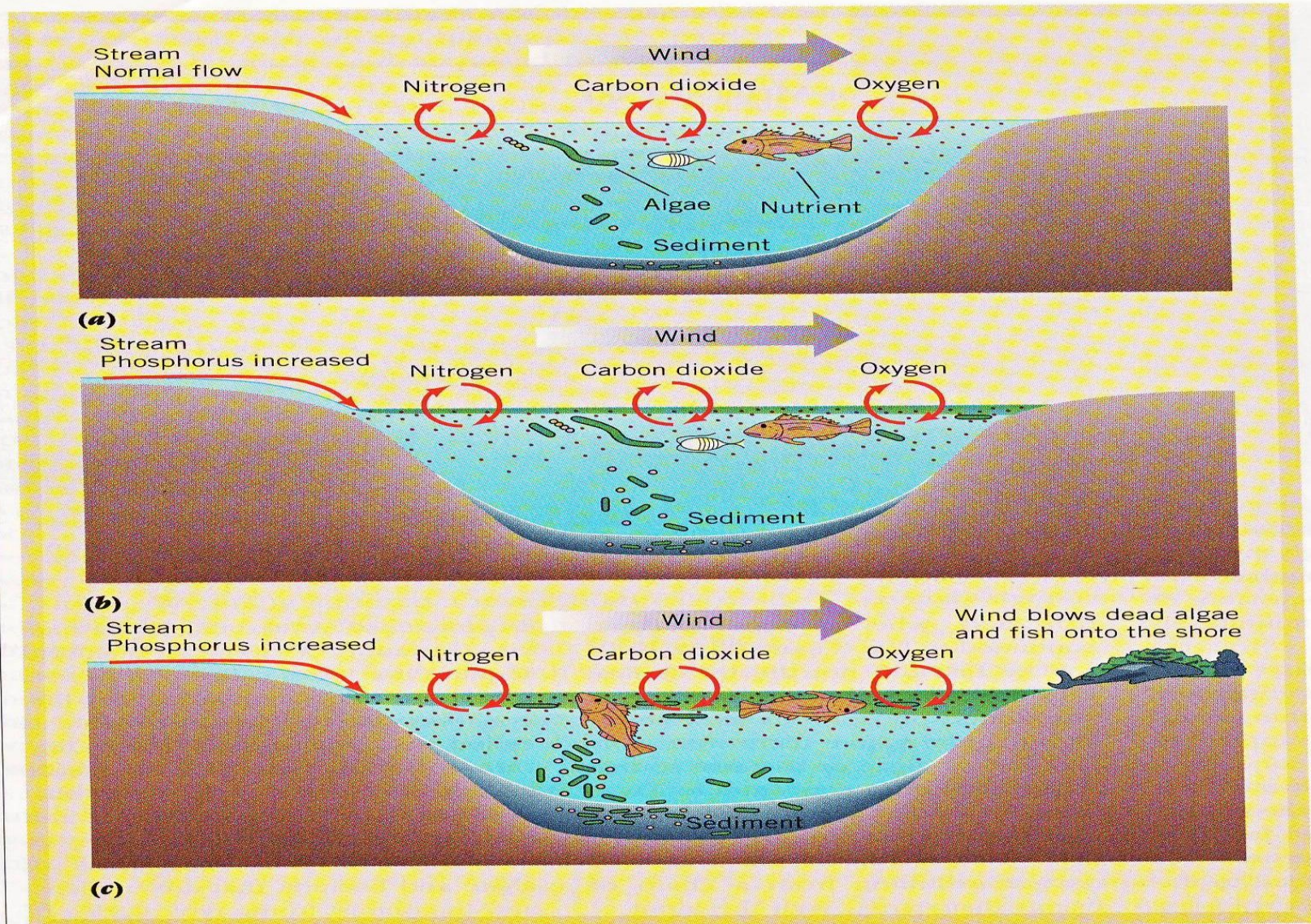
<i>Pollutant Category</i>	<i>Examples of Sources</i>	<i>Comments</i>
Dead organic matter Pathogens	Raw sewage, agricultural waste, urban garbage Human and animal excrement and urine	Produces biochemical oxygen demand and diseases. Examples: Recent cholera epidemics in South America and Africa; 1993 epidemic of cryptosporidiosis in Milwaukee, Wisconsin. See discussion of fecal coliform bacteria under "Waterborne Disease."
Organic chemicals	Agricultural use of pesticides and herbicides (see Chapter 11); industrial processes that produce dioxin (Chapter 14)	Potential to cause significant ecological damage and human health problems. Many of these chemicals pose hazardous waste problems (see Chapter 27).
Nutrients	Phosphorus and nitrogen from agricultural and urban land use (fertilizers) and wastewater from sewage treatment	Major cause of artificial eutrophication. Nitrates in groundwater and surface waters can cause pollution and damage to ecosystems and people.
Heavy metals	Agricultural, urban, and industrial use of mercury, lead, selenium, cadmium, and so on (see Chapter 14)	Can cause significant ecosystem damage and human health problems. For example, mercury from industrial processes that is discharged into water (see Chapter 14).
Acids	Sulfuric acid ( $H_2SO_4$ ) from coal and some metal mines; industrial processes that dispose of acids improperly	Acid mine drainage is a major water pollution problem in many coal mining areas, damaging ecosystems and spoiling water resources.
Sediment	Runoff from construction sites, agricultural runoff, and natural erosion	Reduces water quality and results in loss of soil resources.
Heat (thermal pollution)	Warm to hot water from power plants and other industrial facilities	Causes ecosystem disruption (see Chapter 14).
Radioactivity	Contamination by nuclear power industry, military, and natural sources (see Chapter 18)	Often related to storage of radioactive waste. Health effects vigorously debated (see Chapters 14 and 18).



**FIGURE 20.2** Relationship between dissolved oxygen and biochemical oxygen demand (BOD) for a stream following the input of sewage.







**FIGURE 20.5** The eutrophication of a lake: (a) an oligotrophic, or low nutrient, lake; the algae (green) abundance is low, the water clear; (b) phosphorus is added to streams and enters the lake; algae growth is stimulated; a dense layer is formed; and (c) the algae layer becomes so dense that the algae at the bottom die; bacteria feed on the dead algae and use up the oxygen; fish die from lack of oxygen.