



Chapter 14

Water Pollution

Water Pollution

- ▣ Water pollution- the contamination of streams, rivers, lakes, oceans, or groundwater with substances produced through human activities and that negatively affect organisms.
- ▣ Point sources- distinct locations that pump waste into a waterway.
- ▣ Nonpoint sources- diffuse areas such as an entire farming region that pollutes a waterway.

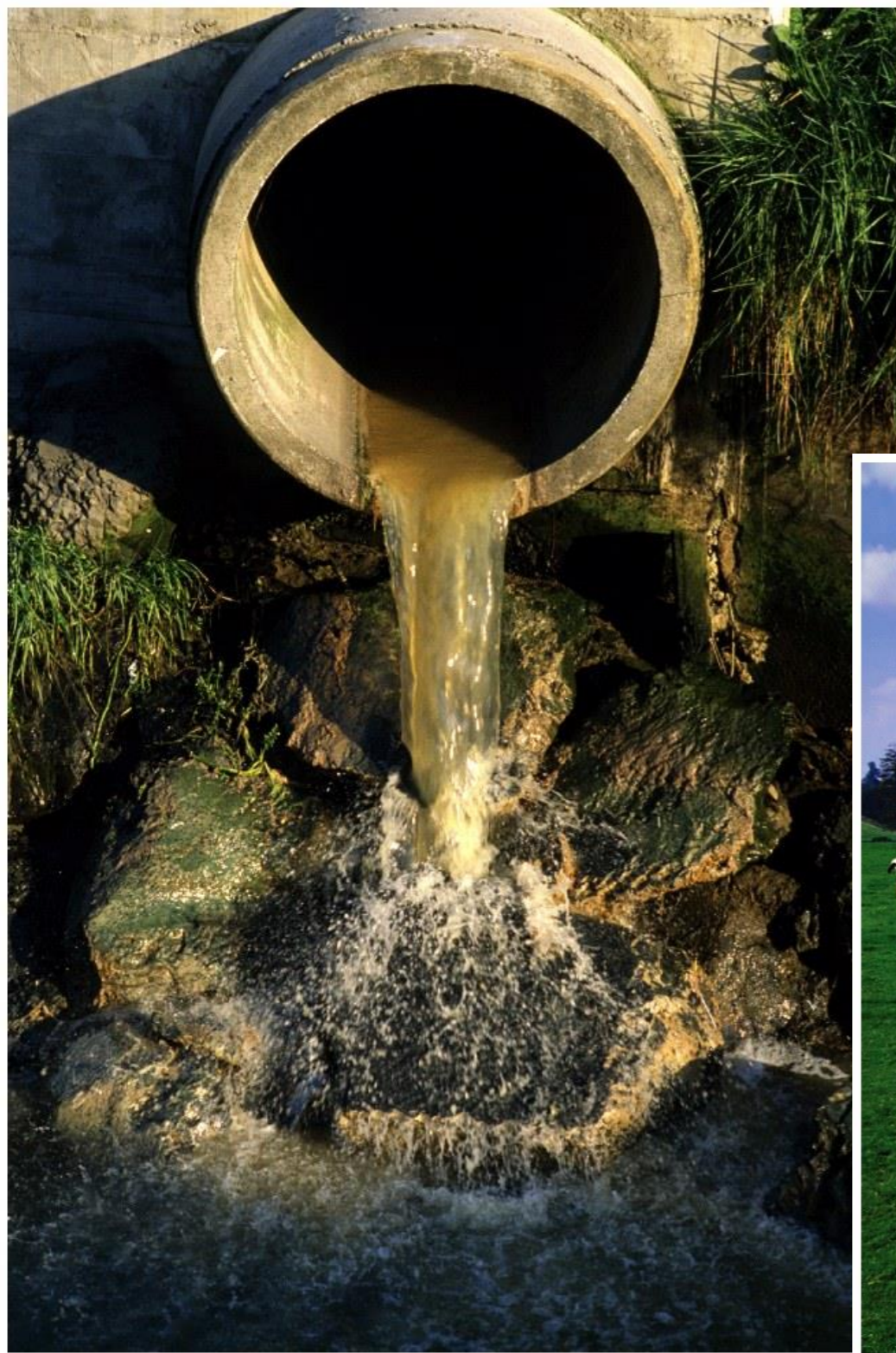


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Figure 14.1b
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Human Wastewater

- ▣ Water produced by human activities such as human sewage from toilets and gray water from bathing and washing clothes or dishes.



Figure 14.2

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Three reasons scientists are concerned about human wastewater:

- ❑ Oxygen-demanding wastes like bacteria that put a large demand for oxygen in the water
- ❑ Nutrients that are released from wastewater decomposition can make the water more fertile causing eutrophication
- ❑ Wastewater can carry a wide variety of disease-causing organisms.

Biochemical Oxygen Demand (BOD)

- ❑ BOD- the amount of oxygen a quantity of water uses over a period of time at a specific temperature.
- ❑ Lower BOD values indicate the water is less polluted and higher BOD values indicate it is more polluted by wastewater.

Eutrophication

- ❑ Eutrophication is an abundance of fertility to a body of water.
- ❑ Eutrophication is caused by an increase in nutrients, such as fertilizers.
- ❑ Eutrophication can cause a rapid growth of algae which eventually dies, causing the microbes to increase the BOD.

Common Diseases from Human Wastewater

- ▣ Cholera
- ▣ Typhoid fever
- ▣ Stomach flu
- ▣ Diarrhea
- ▣ Cholera
- ▣ Hepatitis

Treatments for Human and Animal Wastewater

- ▣ Septic systems- a large container that receives wastewater from the house.

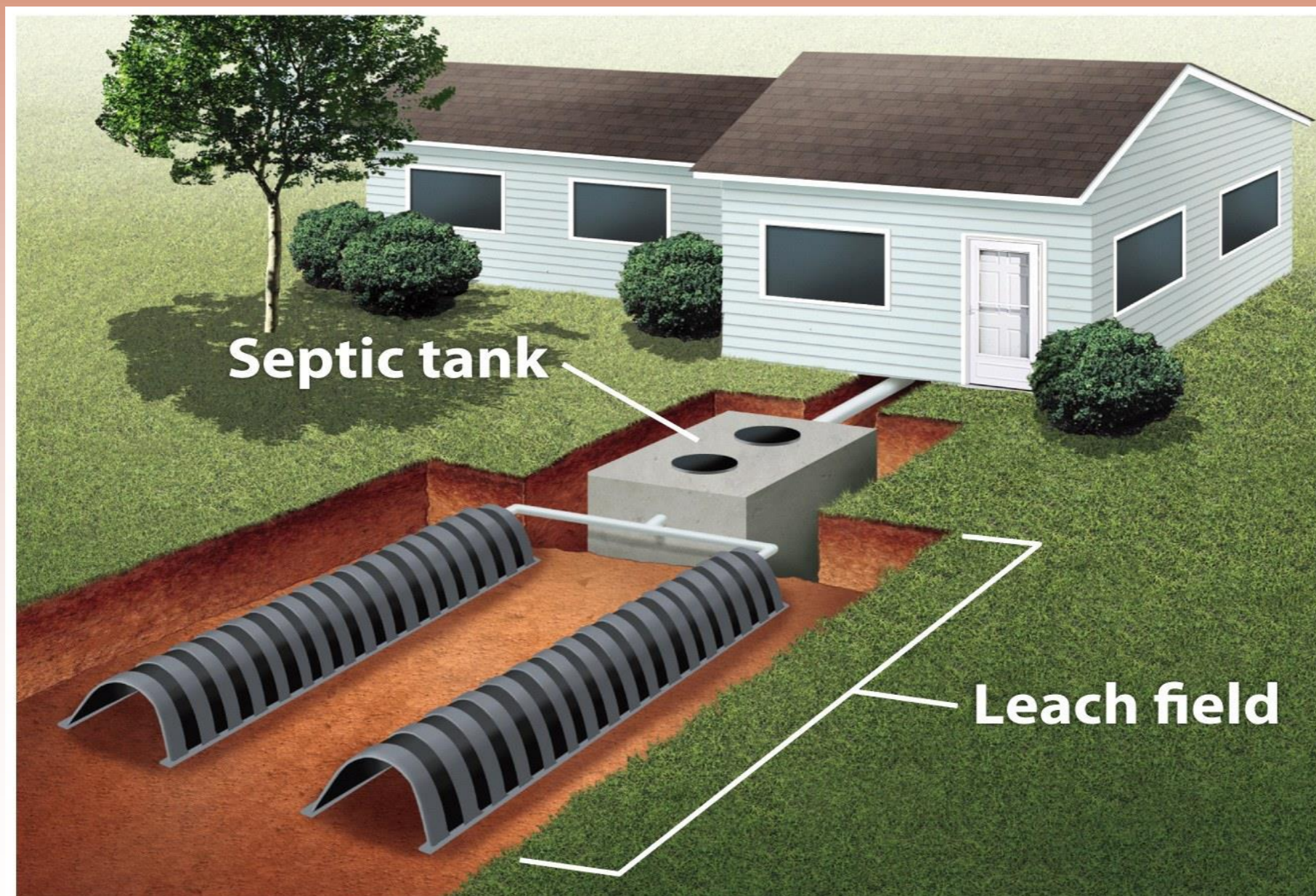


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Treatments for Human and Animal Wastewater

- ▣ Sewage Treatment Plants- centralized plants in areas with large populations that receive wastewater via a network of underground pipes.

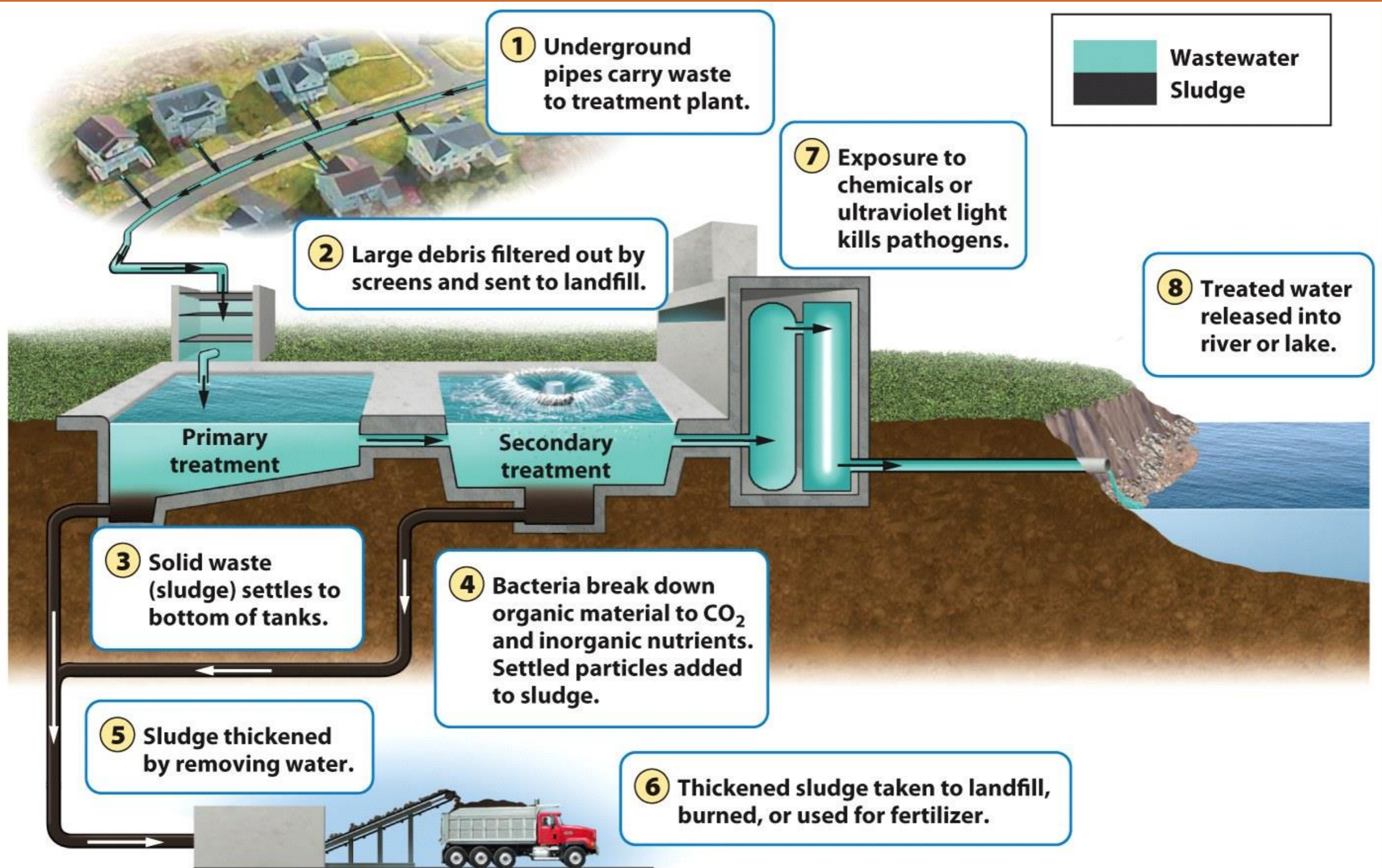


Figure 14.6

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Treatments for Human and Animal Wastewater

- ▣ Manure lagoons- large, human-made ponds lined with rubber to prevent the manure from leaking into the groundwater. After the manure is broken down by bacteria, it is spread onto fields as fertilizers.



Figure 14.7

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Heavy Metals and Other Substances that can threaten human Health and the Environment

- ▣ Lead
- ▣ Arsenic
- ▣ Mercury
- ▣ Acids
- ▣ Synthetic compounds (pesticides, pharmaceuticals, and hormones)

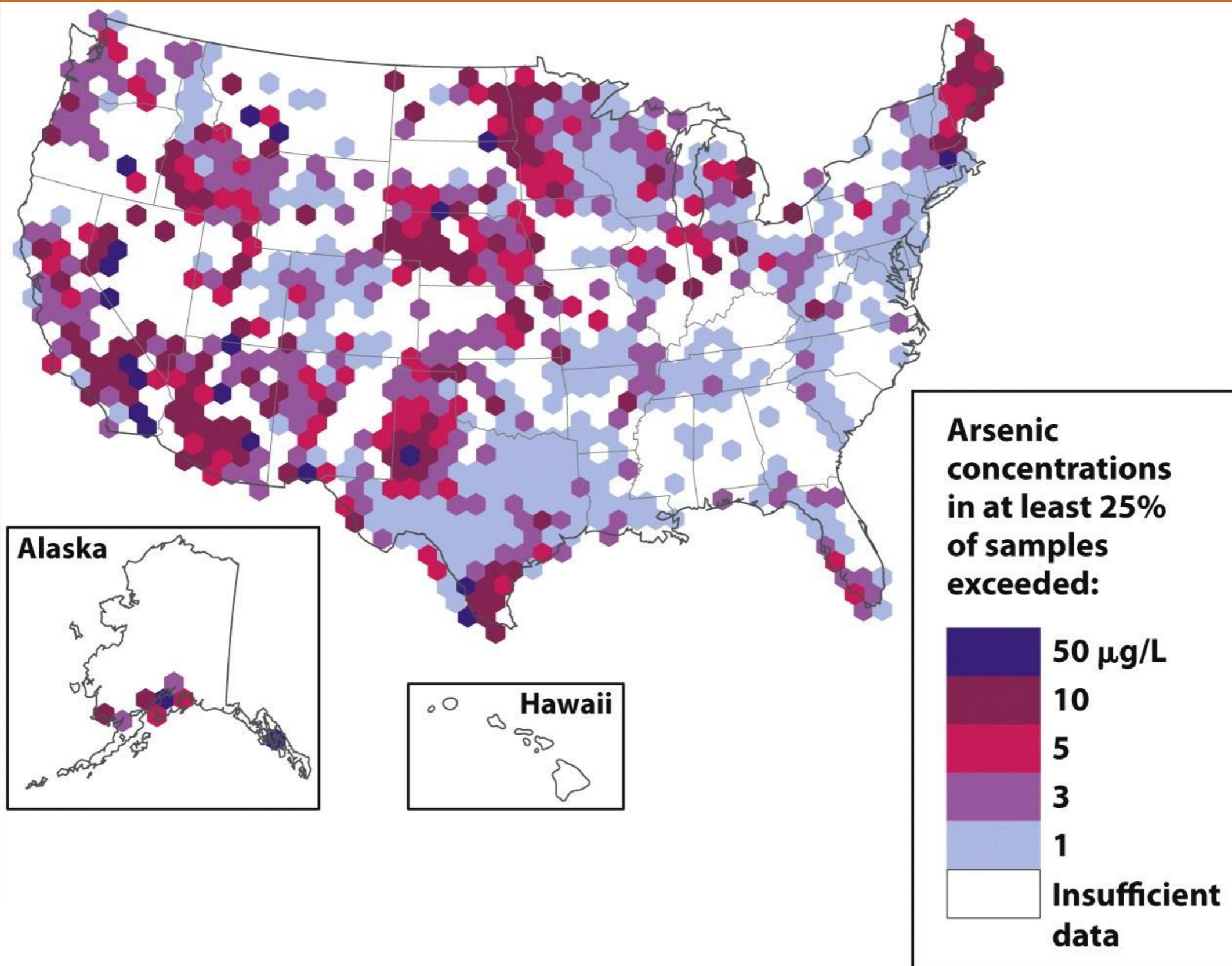


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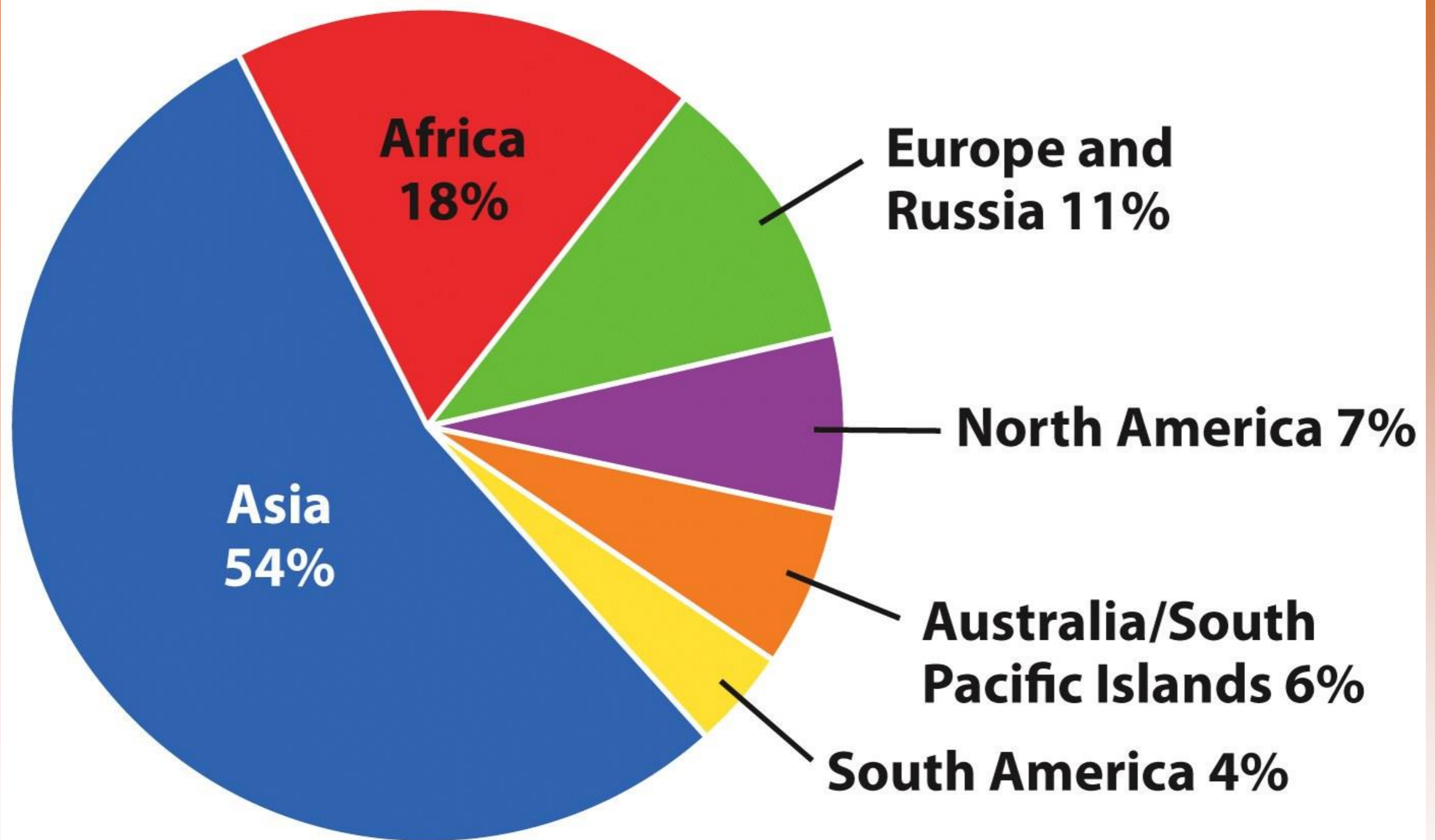


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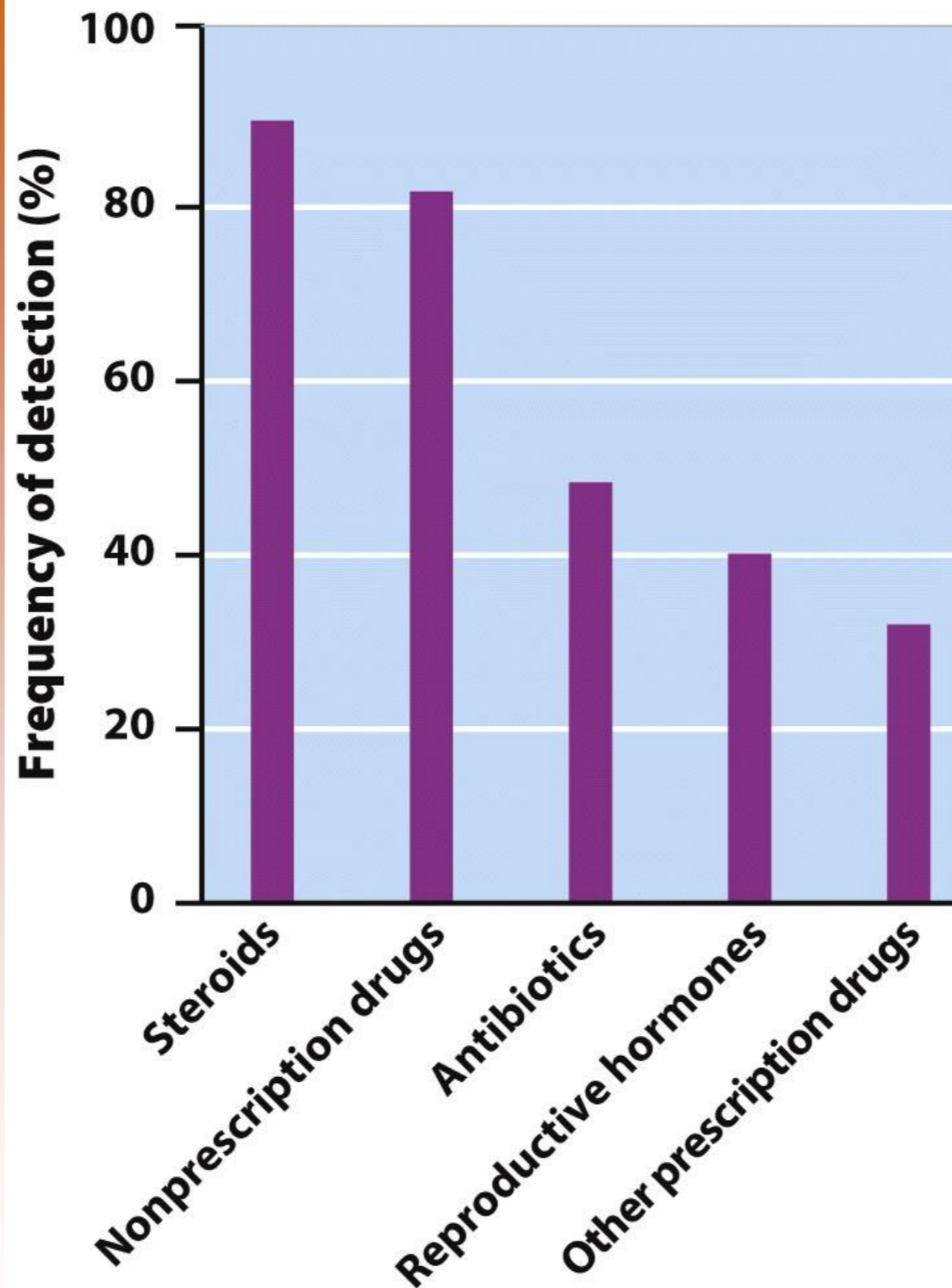
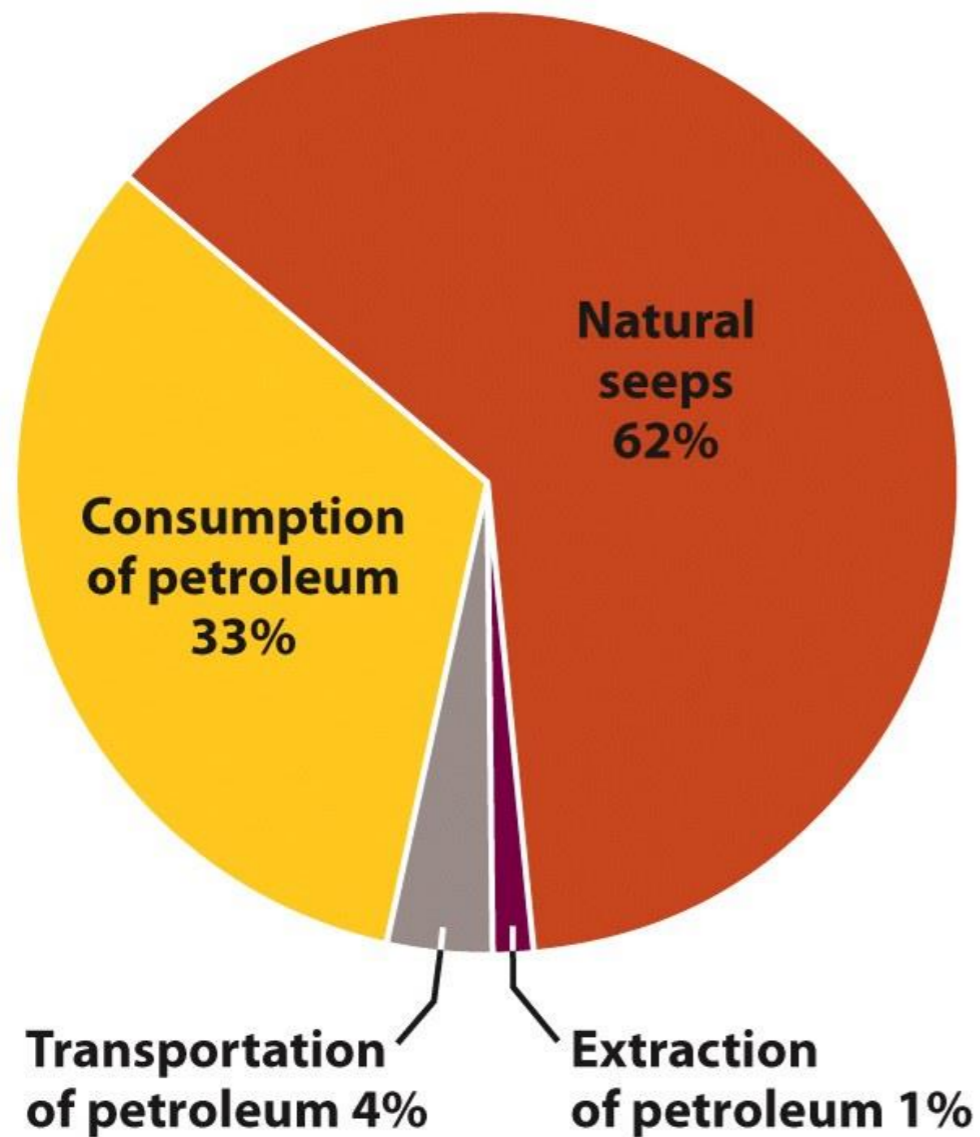


Figure 14.12

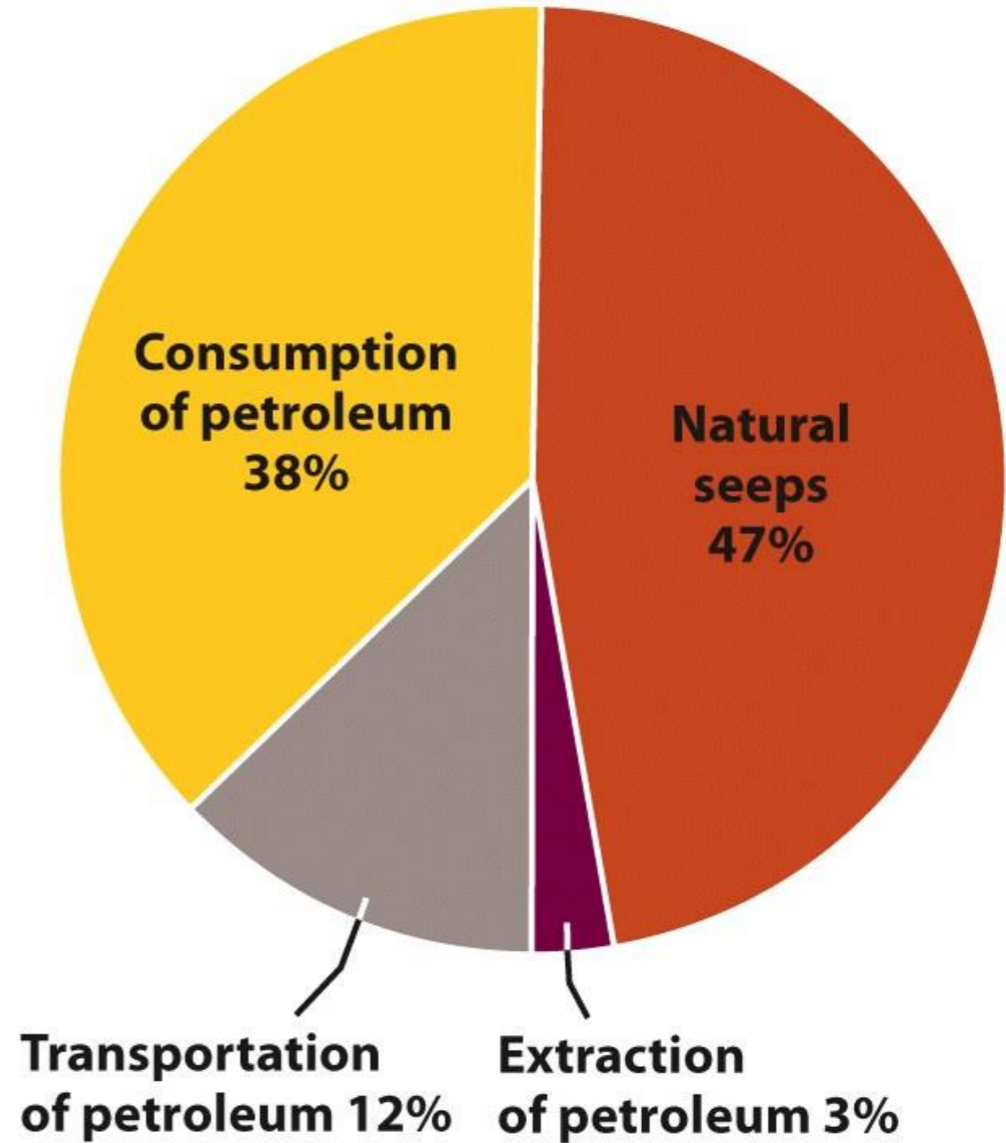
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Oil Pollution



(a) North American marine waters



(b) Worldwide marine waters



Figure 14.14

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Ways to Remediate Oil Pollution

- ▣ Containment using booms to keep the floating oil from spreading.
- ▣ Chemicals that help break up the oil, making it disperse before it hits the shoreline.
- ▣ Bacteria that are genetically engineered to consume oil

Other Water Pollutants

- ▣ Solid waste pollution (garbage)
- ▣ Sediment pollution (sand, silt and clay)
- ▣ Thermal pollution
- ▣ Noise pollution



Figure 14.17

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Water Laws

- ▣ Clean Water Act- (1972) supports the “protection and propagation of fish, shellfish, and wildlife and recreation in and on the water”.
- ▣ Issued water quality standards that defined acceptable limits of various pollutants in U.S. waterways.

Water Laws

- ▣ Safe Drinking Water Act- (1974, 1986, 1996) sets the national standards for safe drinking water.
- ▣ It is responsible for establishing maximum contaminant levels (MCL) for 77 different elements or substances in both surface water and groundwater.

TABLE 14.1

The maximum contaminant levels (MCL) for a variety of contaminants in drinking water as determined by the U.S. Environmental Protection Agency, in parts per billion (ppb)

Contaminant category	Contaminant	Maximum contaminant level (ppb)
Microorganism	Giardia	0
Microorganism	Fecal coliform	0
Inorganic chemical	Arsenic	10
Inorganic chemical	Mercury	2
Organic chemical	Benzene	5
Organic chemical	Atrazine	3

Source: U.S. Environmental Protection Agency, <http://www.epa.gov/safewater/contaminants/index.html>.

Table 14.1

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TABLE 14.2**The current leading causes and sources of impaired waterways in the United States**

	Causes of impairment	Sources of impairment
Streams and rivers	Bacterial pathogens, habitat alteration, oxygen depletion	Agriculture, water diversions, dam construction
Lakes, ponds, and reservoirs	Mercury, PCBs, nutrients	Atmospheric deposition, agriculture
Bays and estuaries	Bacterial pathogens, oxygen depletion, mercury	Atmospheric deposition, municipal discharges including sewage

Source: Data from U.S. Environmental Protection Agency. 2004. *National Water Quality Inventory: Report to Congress*.

Table 14.2

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