



Chapter 14

Water Pollution

Chesapeake Bay...

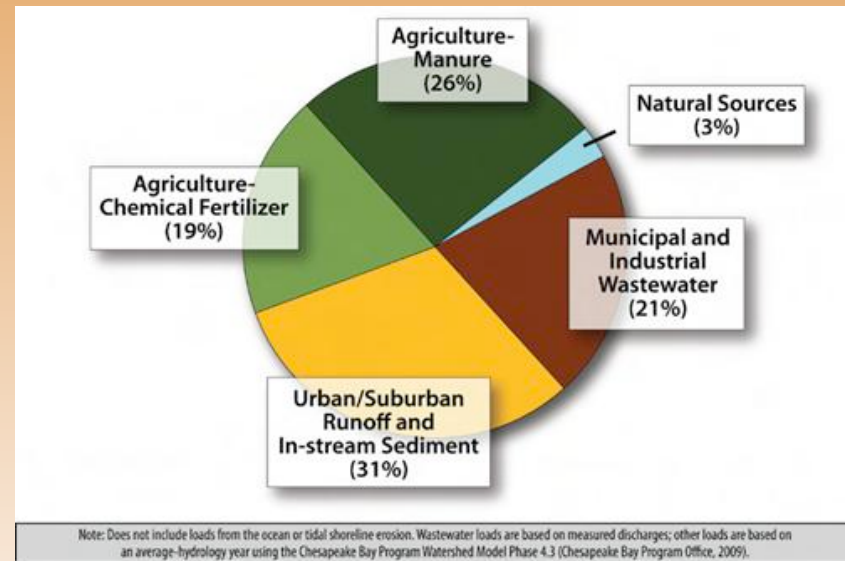
America's largest estuary

The Watershed



Unnumbered 14 p381
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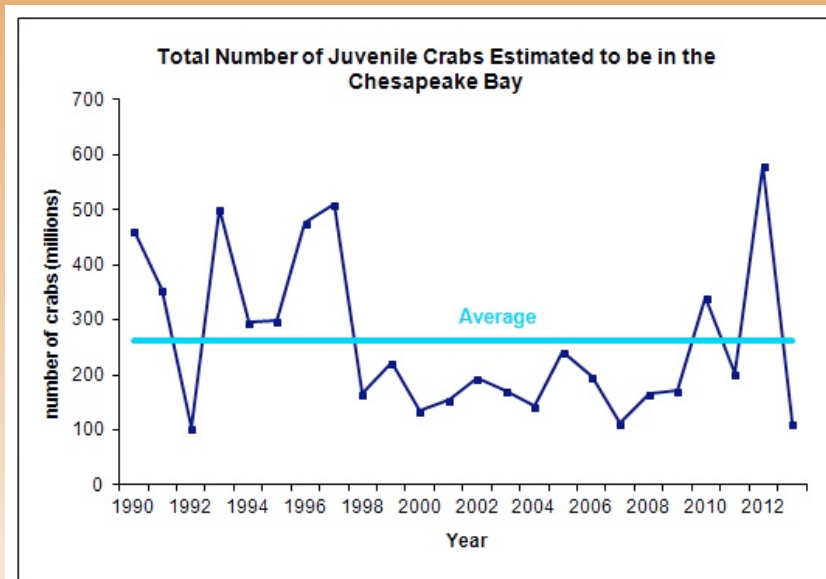
Inputs



Chesapeake Bay

Conservation measures include reducing the “catch”

Blue Crab...indicator species



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.

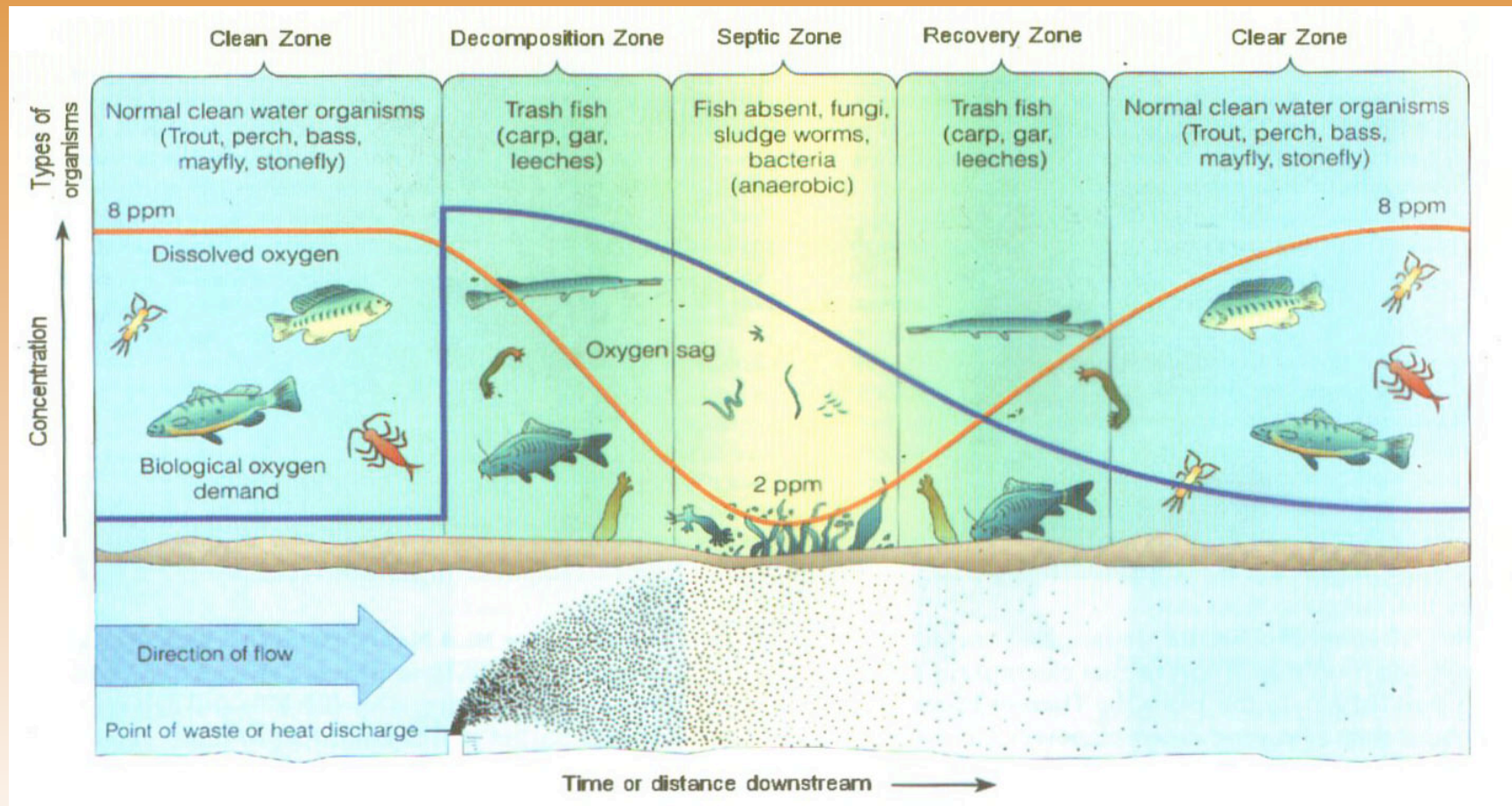
Biochemical Oxygen Demand (BOD)

- ▣ 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.

Biochemical Oxygen Demanding Wastes (BOD)



The Oxygen Sag Curve



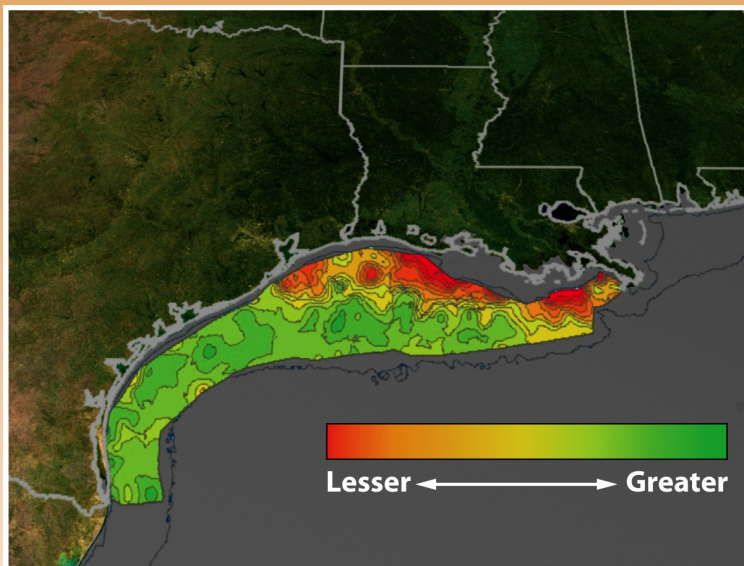
Eutrophication

- ❑ 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.

Eutrophication – waterways that are
“well fed” with nutrients.



Dead Zones



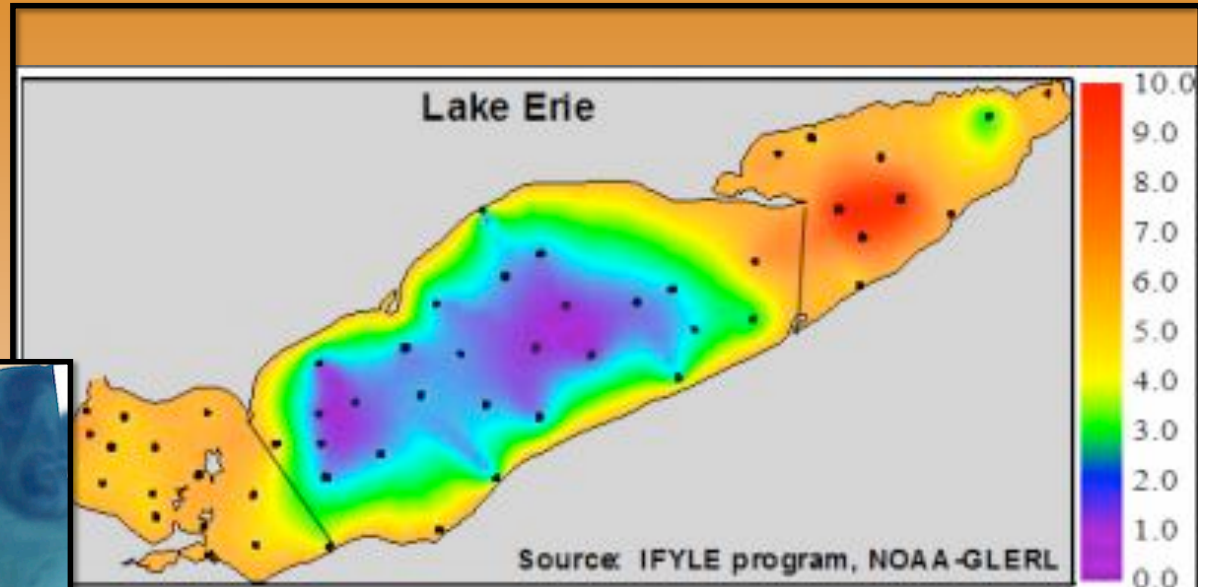
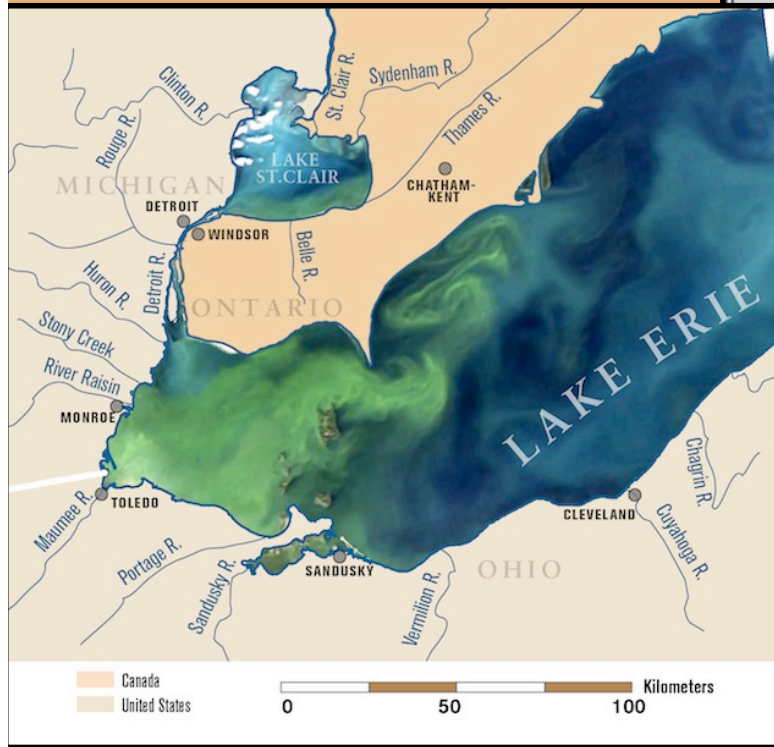
Oxygen concentrations in Gulf Coast waters

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Figure 14.3b
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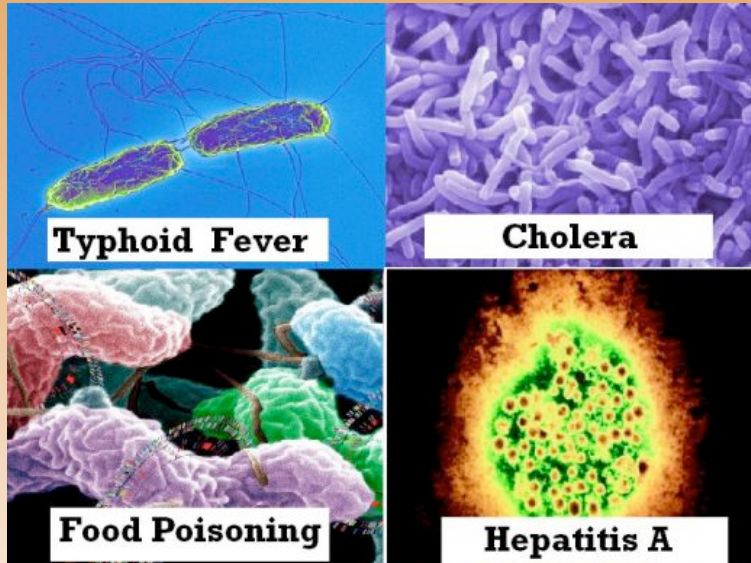
Lake Erie Dead Zones



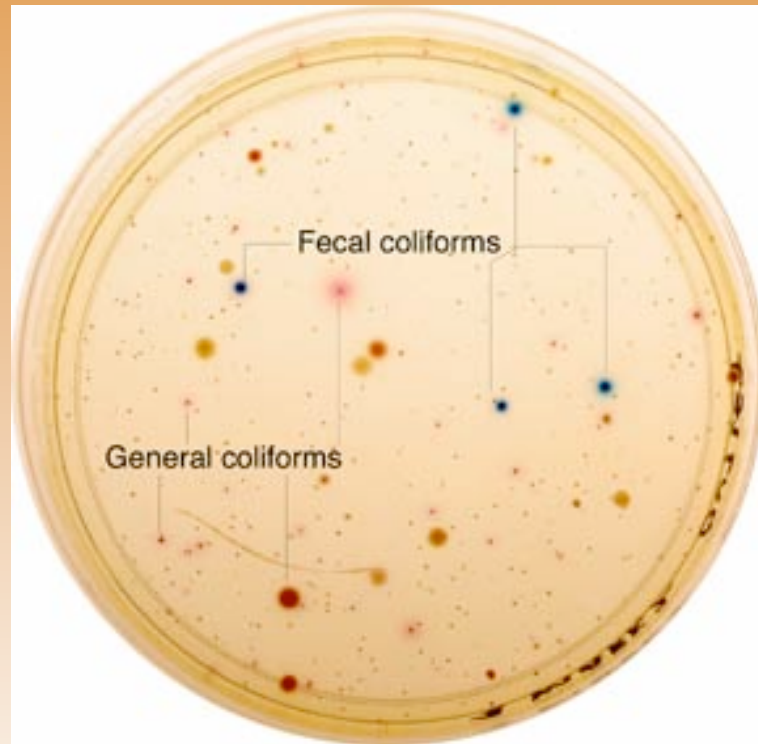
Common Diseases from Human Wastewater and other sources

- ▣ Cholera
- ▣ Typhoid fever
- ▣ Dysentery (Amoebic dysentery)
- ▣ Diarrhea (symptom?)
- ▣ Cryptosporidia
- ▣ Giardia
- ▣ Hepatitis A

Diseases associated with Water Pollution



Indicator Species...Fecal Coliforms...Raw Sewage



Treatments for Human and Animal Wastewater

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

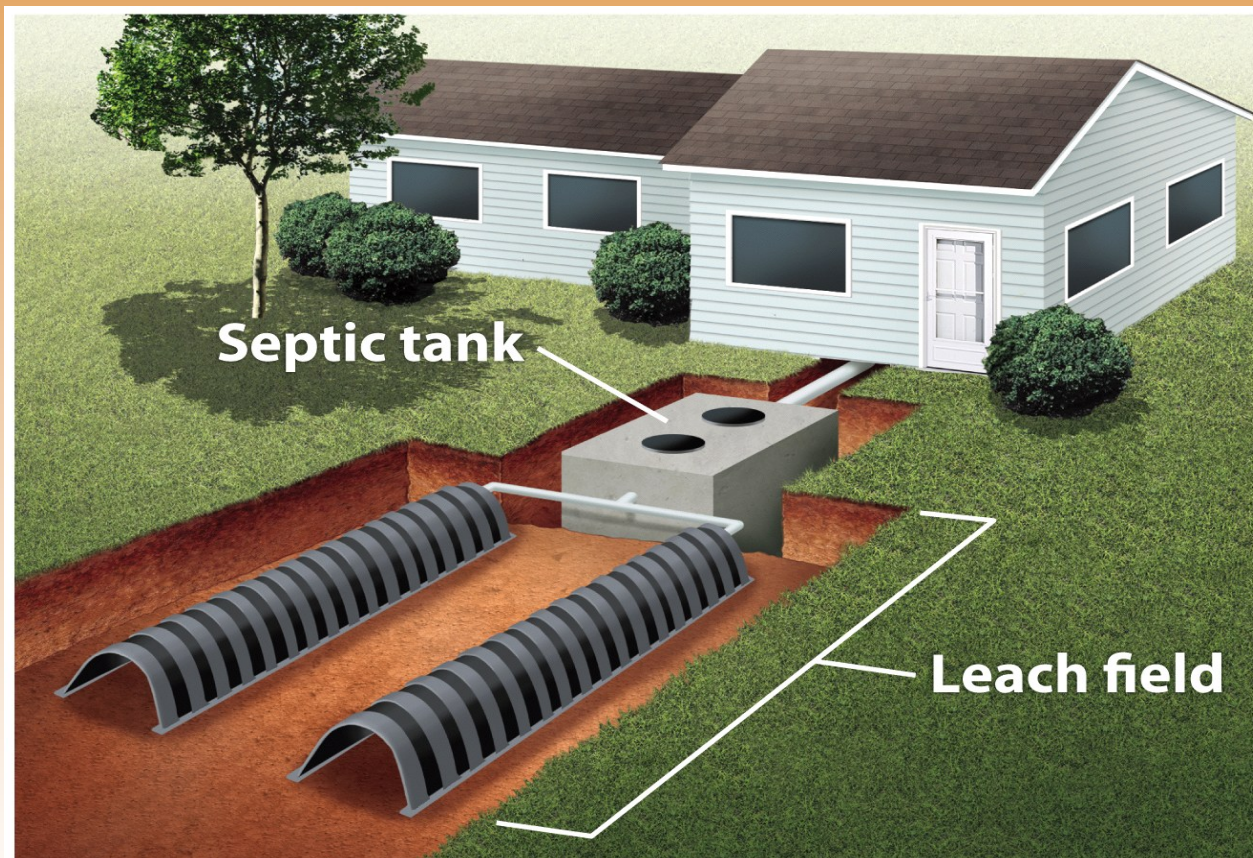


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Treatments for Human and Animal Wastewater

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

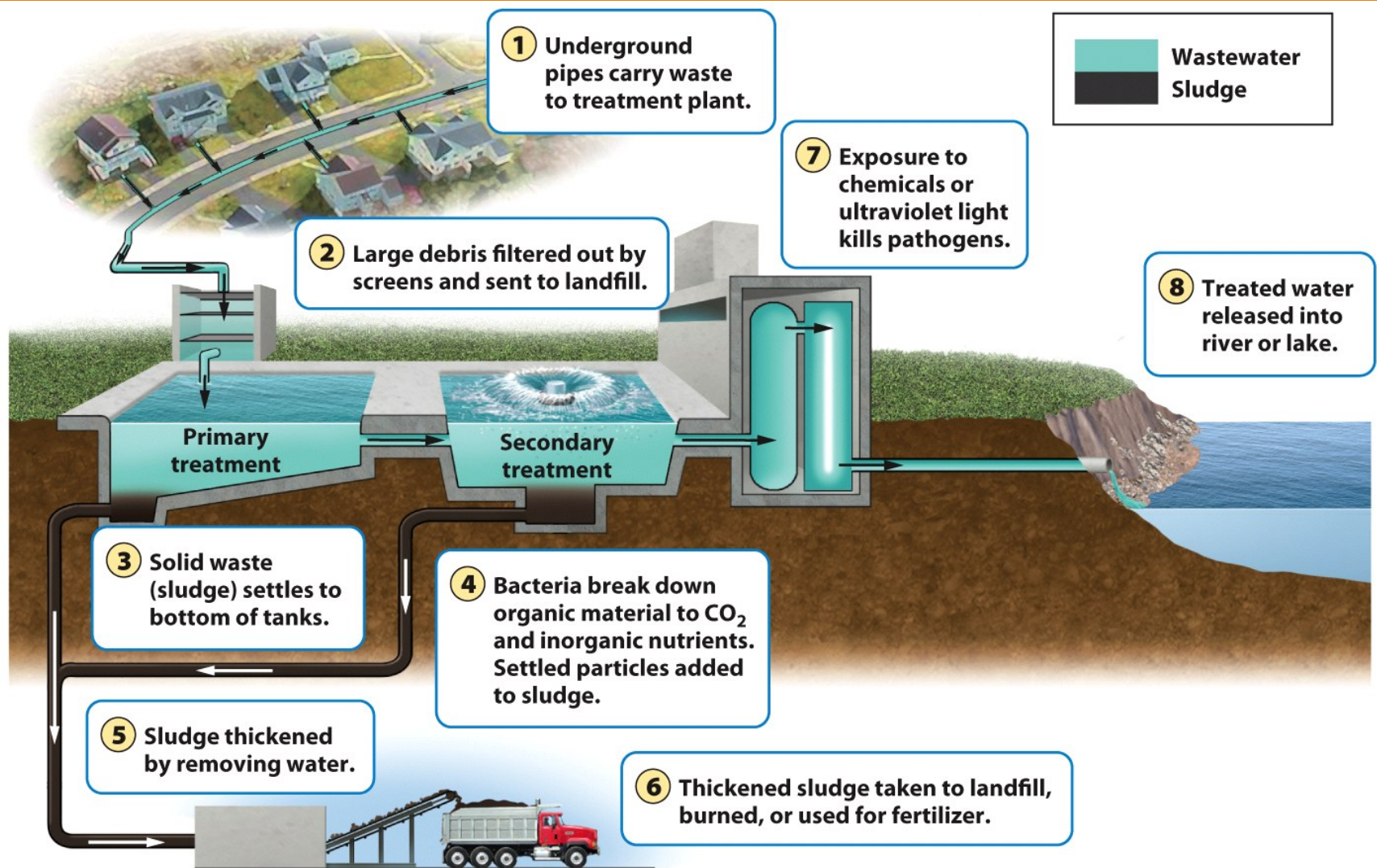
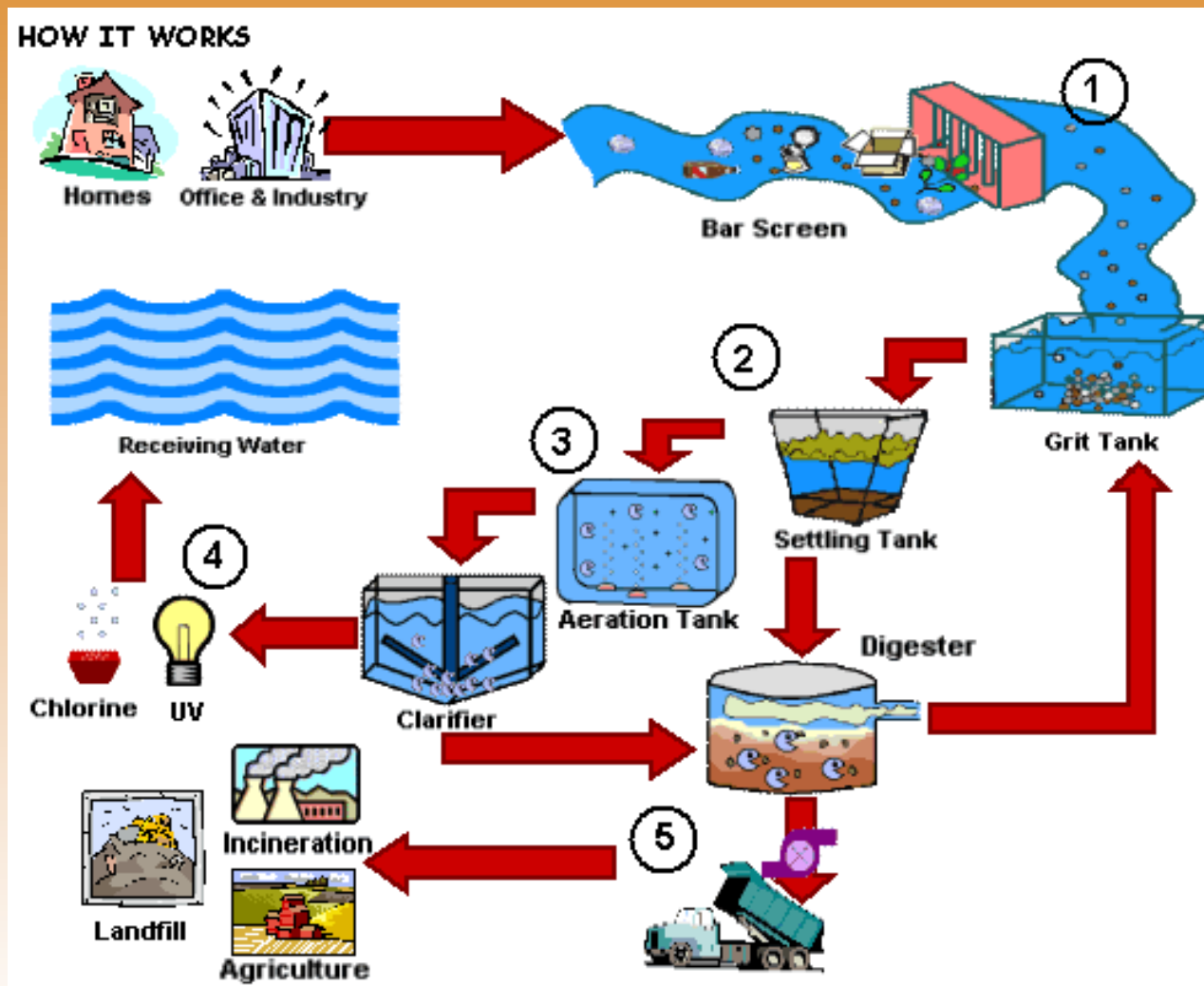


Figure 14.6

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Wastewater Treatment Plants



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.



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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)

Toxins...sources...effects

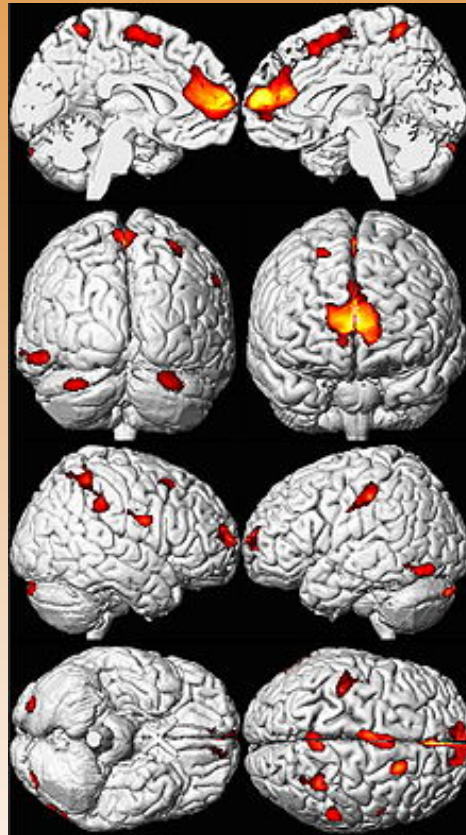
TABLE 17.1 Some chemicals of major concern			
Chemical	Sources	Type	Effects
Lead	Paint, gasoline	Neurotoxin	Impaired learning, nervous system disorders, death
Mercury	Coal burning, fish consumption	Neurotoxin	Damaged brain, kidneys, liver, and immune system
Arsenic	Mining, groundwater	Carcinogen	Cancer
Asbestos	Building materials	Carcinogen	Impaired breathing, lung cancer
Polychlorinated biphenyls (PCBs)	Industry	Carcinogen	Cancer, impaired learning, liver damage
Radon	Soil, water	Carcinogen	Lung cancer
Vinyl chloride	Industry, water from vinyl chloride pipes	Carcinogen	Cancer
Alcohol	Alcoholic beverages	Teratogen	Fetuses with reduced fetal growth, brain and nervous system damage
Atrazine	Herbicide	Endocrine disruptor	Feminization of males, low sperm counts
DDT	Insecticide	Endocrine disruptor	Feminization of males, thin eggshells of birds
Phthalates	Plastics, cosmetics	Endocrine disruptor	Feminization of males

Table 17.1

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Lead



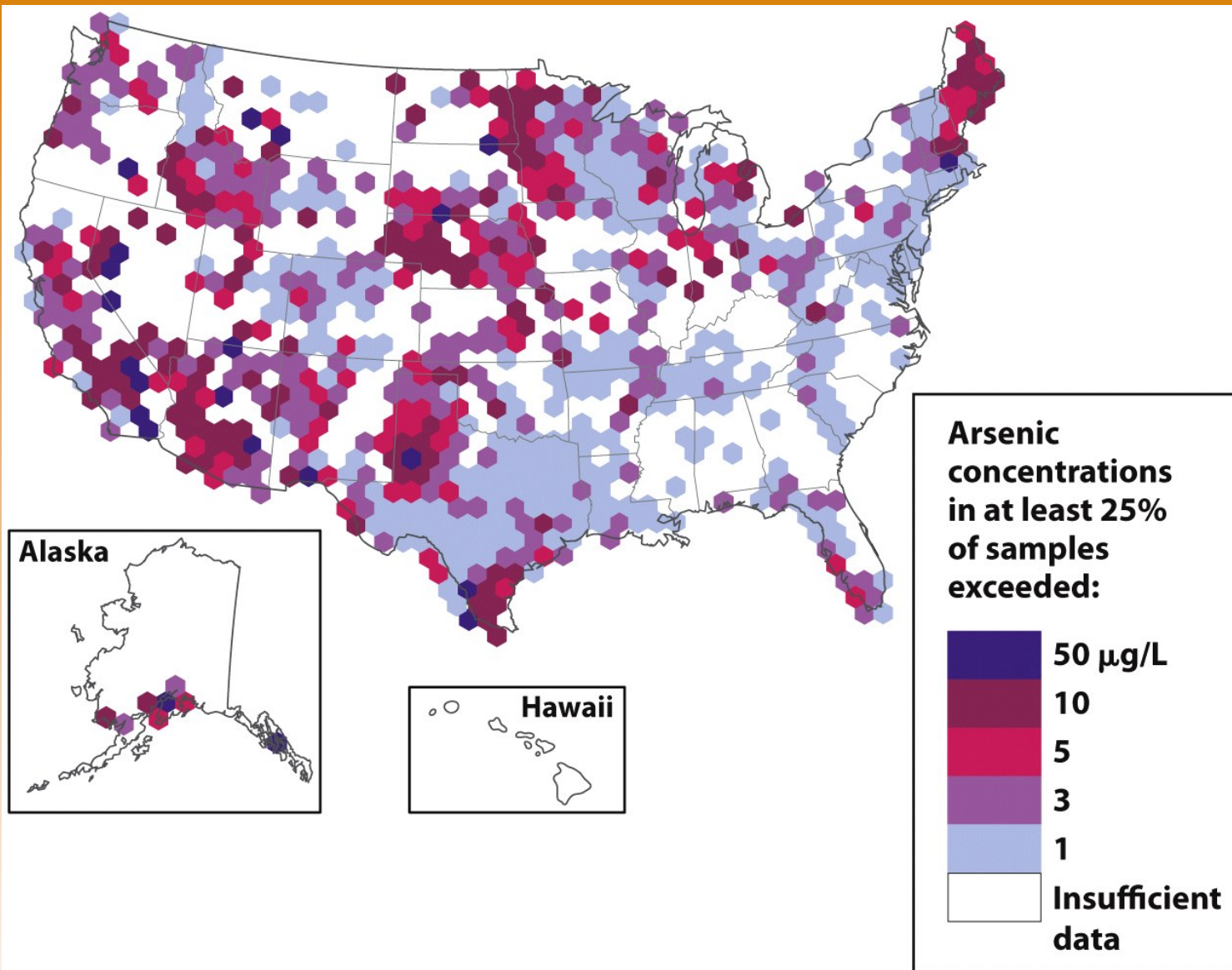


Figure 14.8

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Mercury produced/released ... mostly by burning coal.

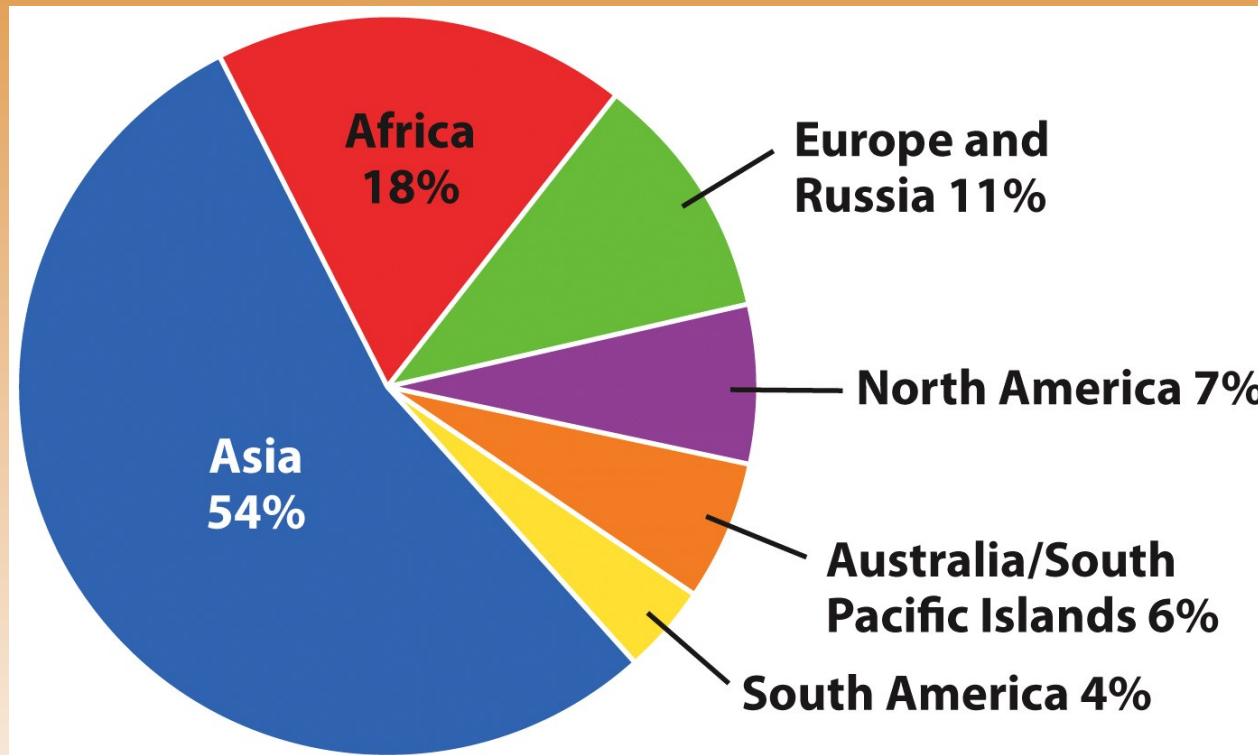


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Acid Mine Drainage

Groundwater reacts with Pyrite (FeS),
other compounds - form acids.



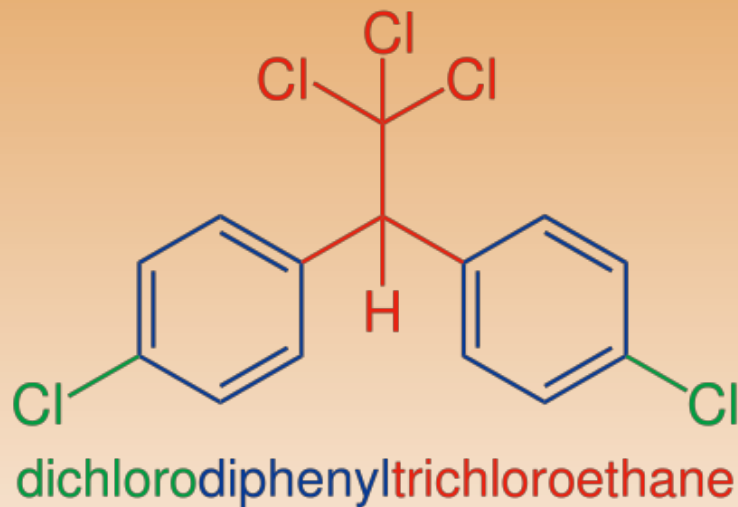
Figure 14.10
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Synthetic Compounds



Synthetic Compounds

Pesticides such as DDT (banned)



PROTECT YOUR CHILDREN
Against Disease-Carrying Insects!

TRIMZ DDT
CHILDREN'S ROOM
WALLPAPER and Ceiling Paper

KILLS FLIES, MOSQUITOS, ANTS
... as well as moths, bedbugs, silverfish and other household pests after contact!

MEDICAL SCIENCE KNOWS many common insects breed in filth, live in filth and carry disease. Science also recognizes the dangers that are present when these disease-carrying insects invade the home. Actual tests have proved that one fly can carry as many as 6,000,000 bacteria! Imagine the health hazard—especially to children—from flies seriously suspected of transmitting such diseases as scarlet fever, measles, typhoid, diarrhea... even diphtheria! Some types of mosquitos carry malaria and yellow fever. And any mosquito bite is painful and easily infected when scratched.

NON-HAZARDOUS to children or adults, to pets or clothes. Certified to be absolutely safe for home use. Tested and commended by *Parents' Magazine*.

GUARANTEED effective against disease-carrying insects for 1 year. Actual tests have proven the insect-killing properties still effective after 2 years of use.

NO SPRAYS! NO LIQUIDS! NO POWDERS! So convenient, so safe because the DDT is fixed to the paper. It can't rub off!

BEAUTIFUL! "Jack and Jill" or "Disney Favorites"—gay new patterns that protect as they beautify a child's room. **DDT CEILING PAPERS, TOO!** Extra protection for your children's room—for every other room in the house. Choice of two tints.

READY-PASTED! Just Dip in Water and Hang!
Anyone can put Trimz Wallpaper up without help or previous experience. Millions have done it—proved it's quick, clean, easy! Nothing to get ready—no tools, paste or mess. Just cut strips to fit, dip in water and hang. It's dry in 20 minutes! Guaranteed to stick—guaranteed to please or money back. And so inexpensive! You can protect your child for \$8 to \$12—depending on size of room.

Trimz DDT Children's Room Wallpaper, Trimz DDT Cedar Closet Wallpaper now available at Department, Chain, Hardware, Paint, and Wallpaper stores everywhere.

Many beautiful new patterns also available in regular Trimz Ready-Pasted Wallpaper at \$1.99, \$2.49, \$2.99 per box.

TRIMZ READY-PASTED WALLPAPER
Another Product of TRIMZ CO., INC., Division of UNITED WALLPAPER

World's Leading Designer and Largest Manufacturer, Merchandise Mart, Chicago 54, Illinois

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Inert Ingredients that help activate other chems...

Ex: Roundup (Herbicide)



Common Herbicide
Lethal to Wetland Species
Conservation July 29, 2008
Study by Rick Relyea

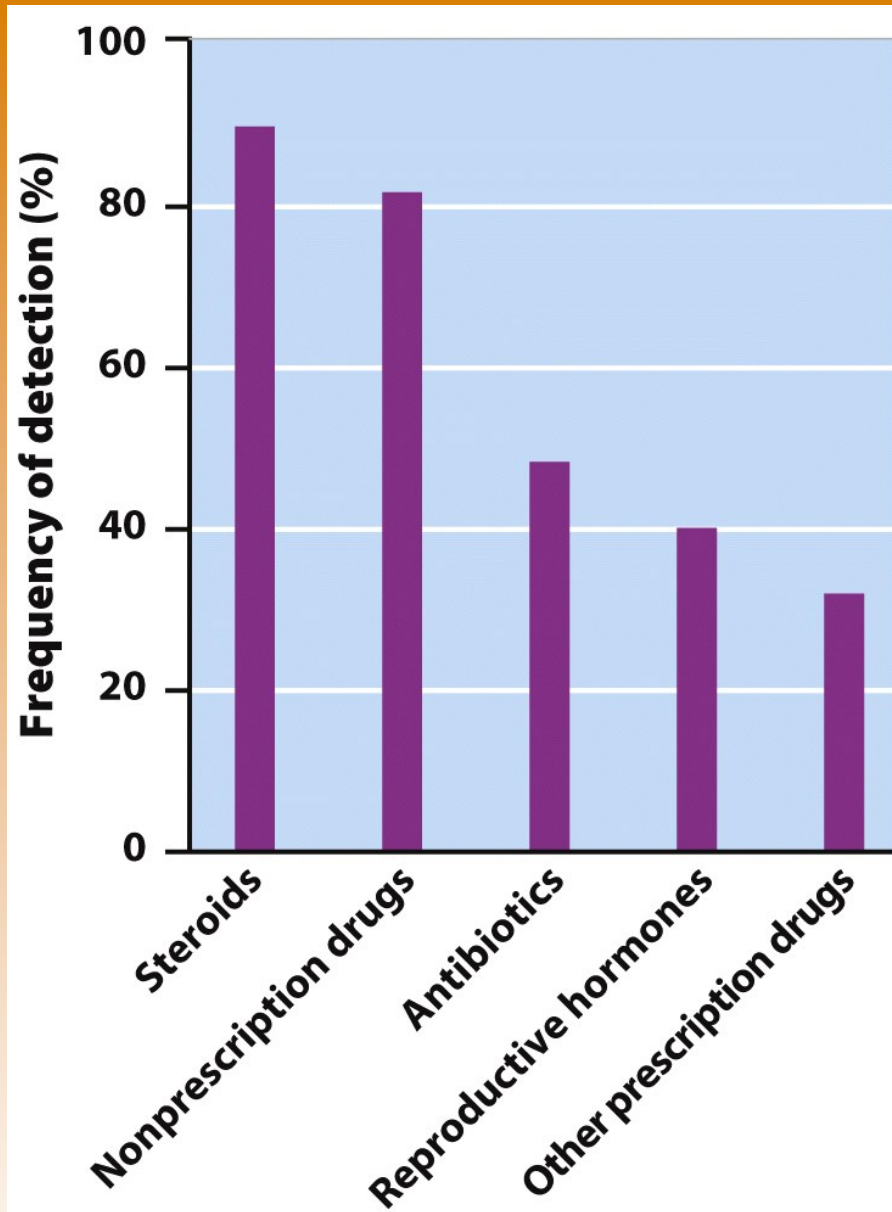


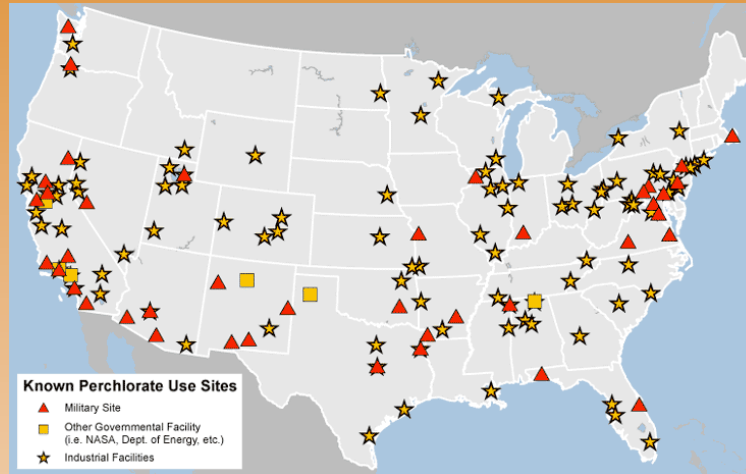
Figure 14.12

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Military Compounds

Ex: Perchlorates in Rocket Fuel



PCB's – Insulating Fluids in Electrical Transformers



Oil Pollution

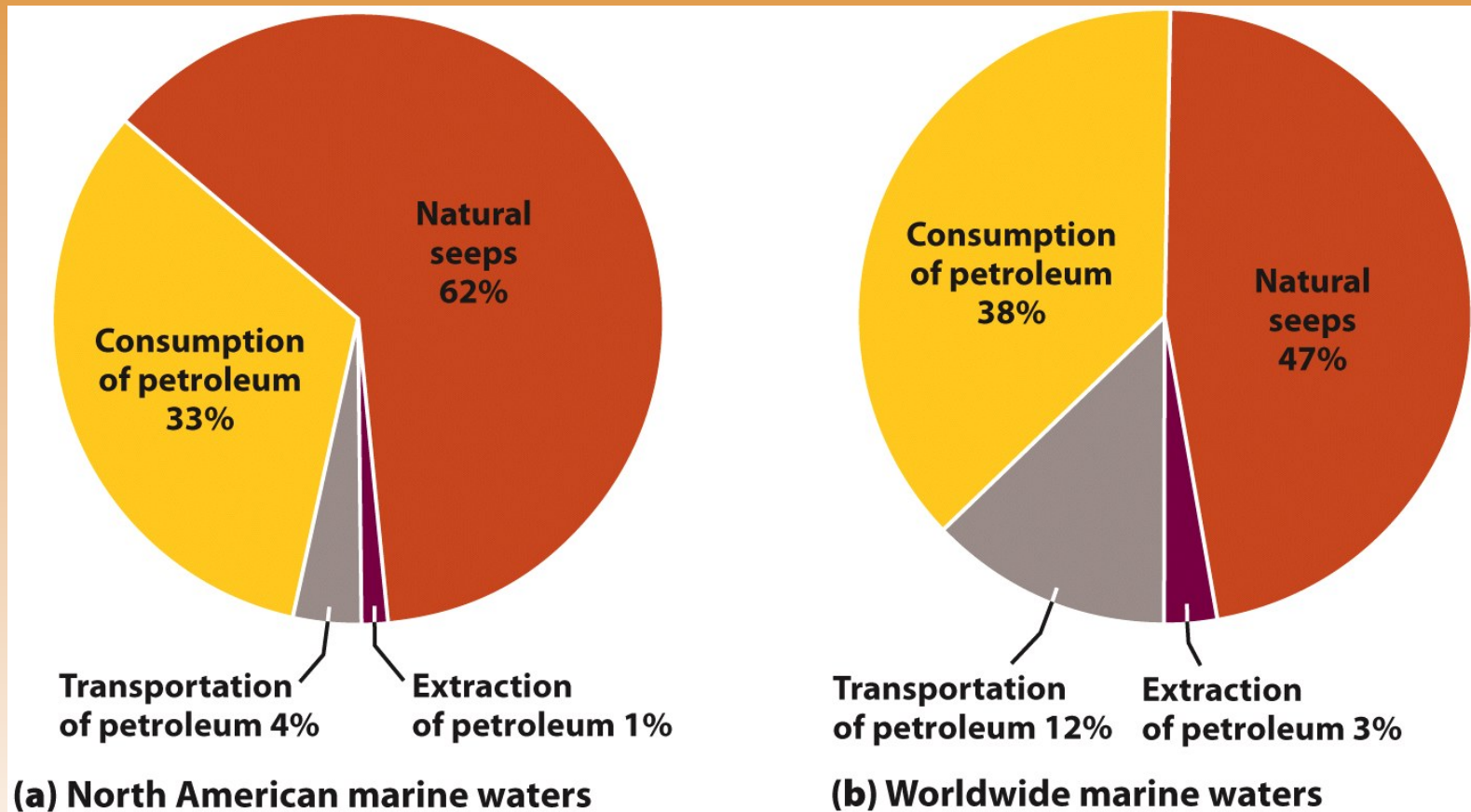
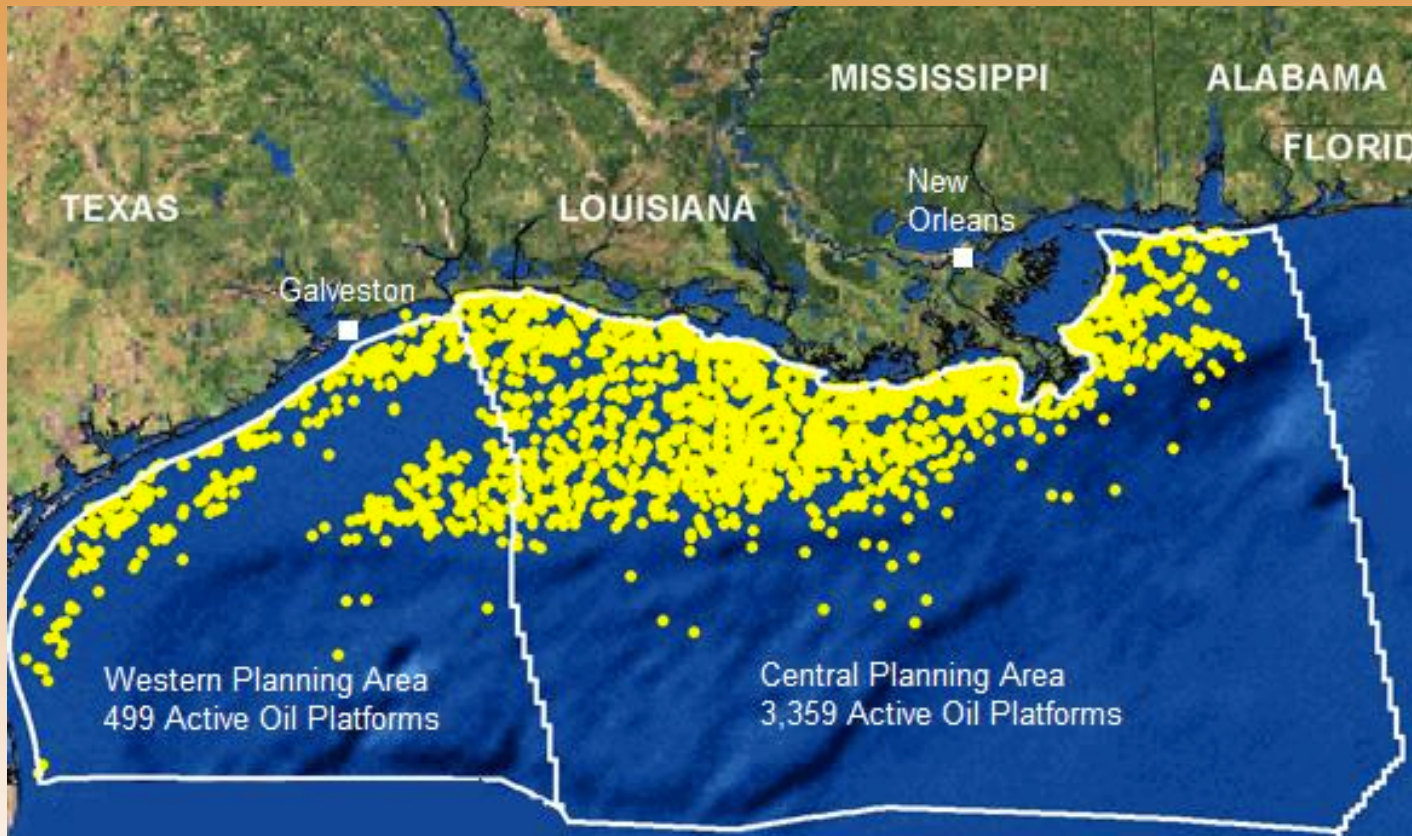


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Offshore Drilling

North America has about 5000 offshore oil platforms



Santa Barbara and Alaska





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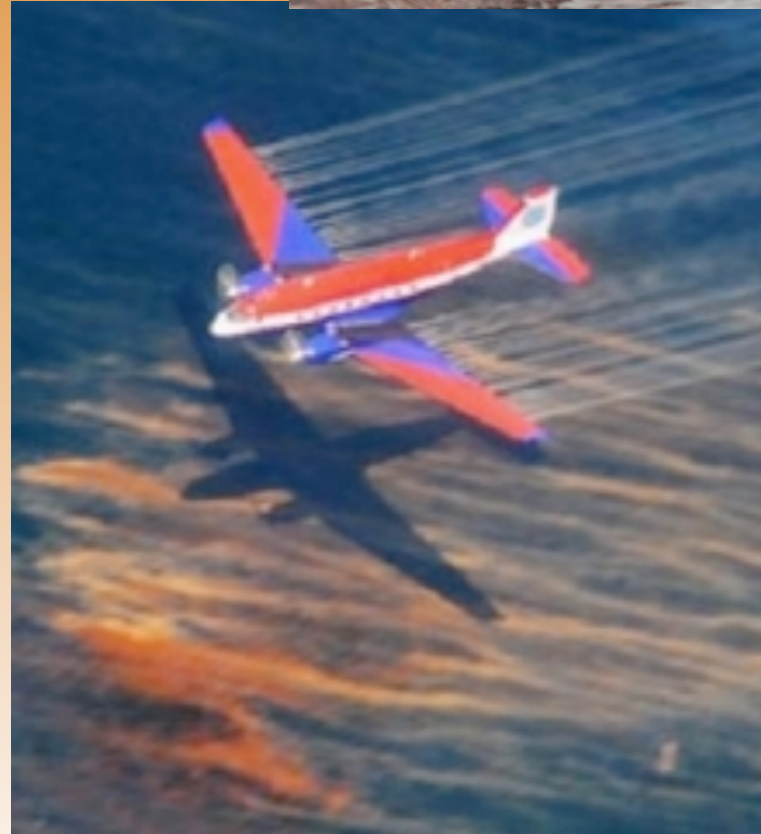
BP Deepwater Horizon



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

Oil Spill Remediation



Other Water Pollutants

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



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Figure 14.18

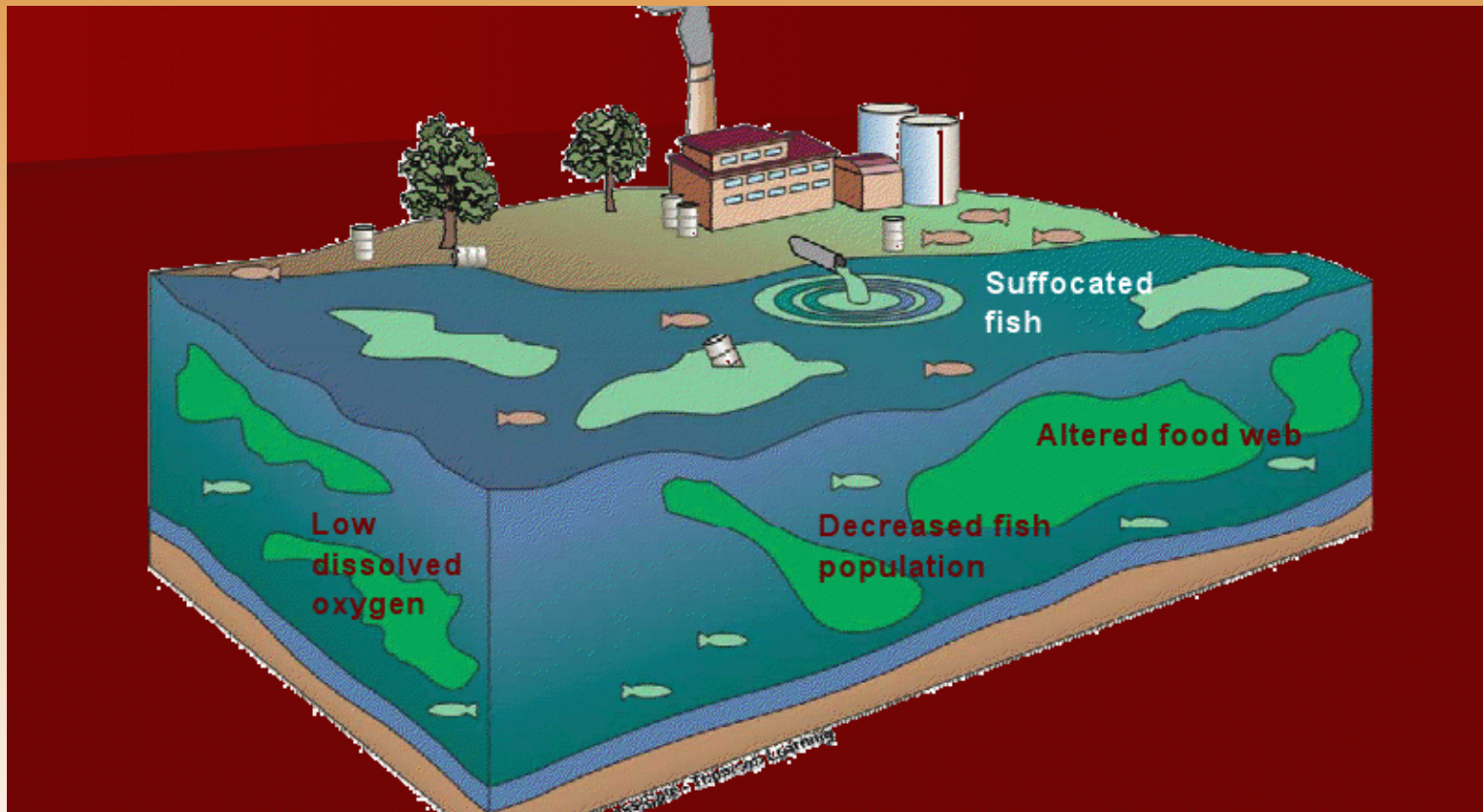
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Thermal Pollution – commonly from power plants



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.

Cuyahoga River fire – springboard to the Clean Water Act.



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

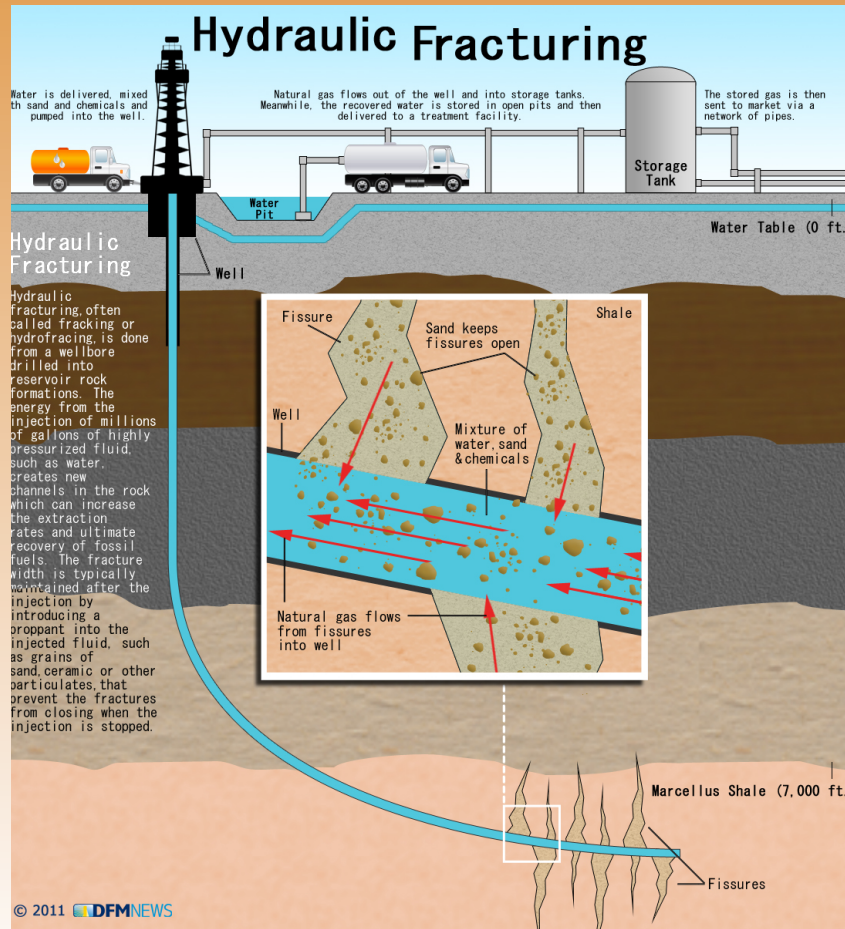
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Threats to Safe Drinking Water Act



PHOTO: MLADEN ANTONIĆ



Green Solutions to Wastewater Treatment



and Company

