

Chapter 15 – Water Quality and Pollution

**How can you determine the health
of the environment from the
quality of the water?**

I. The water pollution problem

A. History

1. Contaminated water has been a source of problems for 100's of years

2. As waters all over the world became contaminated, infectious diseases became more common; soon people realized the link between contaminated water and human disease



3. Direct dumping of pollutants into waterways was banned in most developed countries, but ocean dumping is still a common practice today



a. Affects the ocean ecosystem

b. May still be a health risk to humans as
pollutants drift back to shore

B. Water Pollution Today

1. Obtaining and using energy resources, along with sewage and chemical disposal, are the major causes of water pollution
2. The health of an ecosystem and its human community are directly influenced by the quality of its water

II. Sources of Water Pollution

A. Largest sources of water pollution

1. Agricultural run-off: contains sediments, pesticides, fertilizers, and plant and animal wastes



Conesus Lake weed beds and surrounding agricultural land use

2. Sewage

a. Contains organic wastes and pathogens from humans

b. In most developed countries, sewage is treated before it is dumped (filters out most, but not all pollutants); in many developing countries, sewage is NOT treated before dumping



The Far Side by Gary Larson

B. Other sources

1. Industry – may contain toxic chemicals
2. Urban run-off – from cities; may contain pathogens, fertilizers, and sediments
3. Mining run-off – may contain sediments and toxic chemicals

4. Construction run-off – may contain sediments, fertilizers, and toxic chemicals

Review Questions

- 1. Is water pollution a new problem? Why or why not?

No, It has been around since the beginning of civilization.

2. What are the two largest sources of water pollution today?

Agricultural runoff and sewage.

-
- 3. Why do you think sewage contamination is such a major problem in developing countries? Try to think of 2 reasons!

Because it costs a lot of money to build and maintain water treatment plants.

III. Types of Water Pollution

A. Chemicals – may be toxic, or directly harmful to living organisms

1. Inorganic Chemicals

a. Includes acids, salts, heavy metals, and plant nutrients (fertilizers), and pesticides



b. Problems resulting:

1. Heavy metals such as lead and mercury from industries can cause brain, liver, and kidney damage, coma, or even death

2. Pesticides from agricultural run-off are toxic to living organisms

3. Acids from mining and urban run-off can disrupt lake ecosystems

4. Eutrophication – plant nutrients (fertilizers) enter aquatic ecosystems through run-off, and promote the runaway growth of algae and aquatic plants



Eutrophication

2. Organic Chemicals

a. Includes gasoline, oils, plastics, some pesticides and fertilizers, solvents, and wood preservatives

b. Problems resulting:

1. Oil spills, leakage from ships, and run-off from roadways cause major damage to ecosystems and harm living organisms

2. Bacterial decomposition of organic substances can deplete the oxygen in the water, depriving fish and other aquatic organisms



Review Questions

- 1. Name 3 examples of inorganic chemical pollutants and 3 examples of organic chemical pollutants.

Inorganic- fertilizers

pesticides

metals

Organic- 1. gasoline

2. oil

3. plastics

2. Of the chemical pollutants discussed, which seems to be the most dangerous to human health? Why?

Fertilizers- because it alters the pH and ecosystems of bodies of water.

3. Describe what a eutrophic lake would look like.

It would look like a layer of green algae is covering it.



B. Radioactivity

1. Includes solid and liquid radioactive wastes from nuclear power plants



2. Problems resulting:

a. Liquid wastes placed in steel storage containers and buried may corrode and allow wastes to leak into groundwater

b. Wastes from leaking containers may make its way to rivers and disrupt ecosystems

© Original Artist
Reproduction rights obtainable from
www.CartoonStock.com



"Yeah, the job's got great benefits, but mainly
I like the safe work environment."

C. Thermal Pollution

1. Definition – a large increase in water temperature due to human activity; usually comes from water used for cooling in power plants and industrial plants



2. Problems resulting:

a. Increased water temperature causes an increase in fish metabolism, requiring them to consume more oxygen

b. As water temperature increases, water can hold LESS dissolved oxygen

c. Warm water is destructive to developing eggs and young fish



Review Questions

1. How do power plants contribute to both radioactive and thermal pollution?

Power plants have waste material and they use water to cool their equipment.

2. Explain why thermal pollution is so dangerous to fish.

- Because warm water holds less oxygen and the fishes metabolism is increased by the warm water.

D. Sediments

- Sediments

- 1. Includes soil particles that run-off into surface waters
- 2. Problems resulting:
 - a. Water becomes cloudy so that less sunlight penetrates for photosynthesis



-
- b. Sediments fill rivers, causing them to become more shallow
 - c. Sediments can clog gills of fish

E. Sewage

1. Includes human and animal waste

2. Problems resulting:

a. Bacterial decomposition of sewage causes a decrease in dissolved oxygen in the water

b. Sewage may contain pathogens (disease causing organisms) that can be passed to other people through contaminated water

- Review Questions

- 1. The main type of water pollution in the Charlotte area is sediment. Why do you think this might be the case?

Because of all the construction

2. What is the link between water pollution and infectious disease?

Water pollution causes infectious diseases to thrive.

IV. Controlling Water Pollution

- A. The first U.S. legislation to control water pollution was enacted over a century ago, however the water pollution problem still exists
- B. Reasons for continued water pollution problems include weak law enforcement and low fines for violations

C. Current Legislation

1. Clean Water Act (1972) – set water quality standards for all 50 states, but is NOT a set of laws to enforce
2. Safe Drinking Water Act (1974) – established minimum safety standards for community water supplies



-
- 3. Clean Water Act Amendment (1985) – set a national goal of making all U.S. surface waters “fishable and swimmable”





A pod of narwhals swim through Arctic Bay.
Photograph by Flip Nicklin

D. Enforcement

1. Local, state, and federal governments are responsible for making and enforcing laws regarding water pollution
2. These laws must be strengthened and enforced if water quality standards are to be met

Review Questions

1. Why do water pollution problems continue even after a century of water pollution control legislation?

Because it costs money to clean and protect water.

2. Name 3 important pieces of legislation that help to regulate water pollution in the U.S.

Clean Water Act

Safe Drinking Water Act

Clean Water Act Ammendment

3. What must happen if the U.S. is to reach the goal of all surface waters being “fishable and swimmable”?

We must stop polluting
water.

V. Water Quality in North Carolina

1. The #1 source of water pollution in NC is stormwater run-off

2. Reasons for the high amount of stormwater run-off include construction, forestry operations, mining operations, crop production, animal feed lots, failing septic systems, land fills, golf courses, roads and parking lots

B. Problems

1. Stormwater carries sediment, oils, toxic residues, pesticides, fertilizers, animal waste, and other pollutants



2. Sediments (the main pollutant) fills rivers and smothers fish

3. Run-off warms mountain streams, destroying habitat for aquatic mountain organisms

4. Animal waste contains fecal coliform bacteria, and possibly other pathogens

C. Solutions

1. Require development to be set back
from creeks and rivers
2. Limit pavement in new development
3. Preserve wetlands since they act as
“nature’s water filters”

Review Questions

1. What is the #1 source of water pollution in N.C.?

- Storm water runoff

2. Describe 3 water pollution problems in N.C.

Golf Courses

Landfills

Lots of construction

3. What can be done to improve water quality in N.C.?

PROTECT WETLANDS!

Require new development to be set back from rivers and creeks.

Limit pavement in new developments