

# Reply to ASK-AN-EARTH-SCIENTIST

Subject: Sources of Water Pollution

- a)What are the sources of water pollution?**
- b)What are the effects of water pollution?**
- c)What are the ways we can take to decrease those problem?**

a)What are the sources of water pollution?

There are many causes for water pollution but two general categories exist: direct and indirect contaminant sources.

Direct sources include effluent outfalls from factories, refineries, waste treatment plants etc.. that emit fluids of varying quality directly into urban water supplies. In the United States and other countries, these practices are regulated, although this doesn't mean that pollutants can't be found in these waters.

Indirect sources include contaminants that enter the water supply from soils/groundwater systems and from the atmosphere via rain water. Soils and groundwaters contain the residue of human agricultural practices (fertilizers, pesticides, etc..) and improperly disposed of industrial wastes. Atmospheric contaminants are also derived from human practices (such as gaseous emissions from automobiles, factories and even bakeries).

Contaminants can be broadly classified into organic, inorganic, radioactive and acid/base. Examples from each class and their potential sources are too numerous to discuss here.

b)What are the effects of water pollution?

The effects of water pollution are varied. They include poisonous drinking water, poisonous food animals (due to these organisms having bioaccumulated toxins from the environment over their life spans), unbalanced river and lake ecosystems that can no longer support full biological diversity, deforestation from acid rain, and many other effects. These effects are, of course, specific to the various contaminants.

c)What are the ways we can take to decrease those problem?

Science provides many practical solutions to minimizing the present level at which pollutants are introduced into the environment and for remediating (cleaning up) past problems. All of these solutions come with some cost (both societal and monetary). In our everyday lives, a great deal can be done to minimize pollution if we take care to recycle materials whose production creates pollution and if we act responsibly with household chemicals and their disposal. Additionally, there are choices we make each day that also can affect the quantity of pollutants our actions will introduce into the environment. Heavily packaged foods, for instance, contain boxes, cartons, bottles etc.. made with polluting dyes, many of which are released from groundwater at municipal land fills. Whether we choose to drive to the corner store rather than walk or ride a bicycle will determine how much we personally contribute to acid and hydrocarbon emissions to the atmosphere (and ultimately to global fresh water supplies).

In the end, there are many choices on the personal and societal level that we must make (consciously or not) that affect the amount of pollution our town or country will be forced to live with. Our standard of living and very way of life is based upon practices which are inherently "dirtier" than those of our distant ancestors, although they too polluted their environment to some extent. Without taking a step backward in terms of our standards of living, the answer seems to lie in a combination of many small changes in our daily practices and paying more for goods and services, so that manufacturers of various materials and drivers of automobiles (for instance) will have cleaner devices with which to conduct their activities.

Comprising over 70% of the Earth's surface, water is undoubtedly the most precious natural resource that exists on our planet. Without the seemingly invaluable compound comprised of hydrogen and oxygen, life on Earth would be non-existent: it is essential for everything on our planet to grow and prosper. Although we as humans recognize this fact, we disregard it by polluting our rivers, lakes, and oceans. Subsequently, we are slowly but surely harming our planet to the point where organisms are dying at a very alarming rate. In addition to innocent organisms dying off, our drinking water has become greatly affected as is our ability to use water for recreational purposes. In order to combat water pollution, we must understand the problems and become part of the solution.

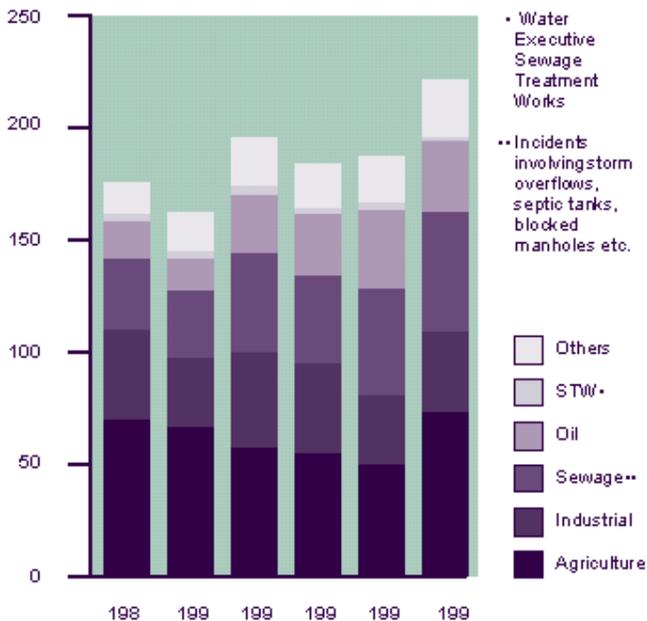
## **POINT AND NONPOINT SOURCES**

According to the American College Dictionary, pollution is defined as: "to make foul or unclean; dirty." Water pollution occurs when a body of water is adversely affected due to the addition of large amounts of materials to the water. When it is unfit for its intended use, water is considered polluted. Two types of water pollutants exist; point source and nonpoint source. Point sources of pollution occur when harmful substances are emitted directly into a body of water. The Exxon Valdez oil spill best illustrates a point source water pollution. A nonpoint source delivers pollutants indirectly through environmental changes. An example of this type of water pollution is when fertilizer from a field is carried into a stream by rain, in the form of runoff which in turn affects aquatic life. The technology exists for point sources of pollution to be monitored and regulated, although political factors may complicate matters. Nonpoint sources are much more difficult to control. Pollution arising from nonpoint sources accounts for a majority of the contaminants in streams and lakes.

## **CAUSES OF POLLUTION**

Many causes of pollution including sewage and fertilizers contain nutrients such as nitrates and phosphates. In excess levels, nutrients over stimulate the growth of aquatic plants and algae. Excessive growth of these types of organisms consequently clogs our waterways, use up dissolved oxygen as they decompose, and block light to deeper waters. This, in turn, proves very harmful to aquatic organisms as it affects the respiration ability of fish and other invertebrates that reside in water.

Pollution is also caused when silt and other suspended solids, such as soil, washoff plowed fields, construction and logging sites, urban areas, and eroded river banks when it rains. Under natural conditions, lakes, rivers, and other water bodies undergo Eutrophication, an aging process that slowly fills in the water body with sediment and organic matter. When these sediments enter various bodies of water, fish respiration becomes impaired, plant productivity and water depth become reduced, and aquatic organisms and their environments become suffocated. Pollution in the form of organic material enters waterways in many different forms as sewage, as leaves and grass clippings, or as runoff from livestock feedlots and pastures. When natural bacteria and protozoan in the water break down this organic material, they begin to use up the oxygen dissolved in the water. Many types of fish and bottom-dwelling animals cannot survive when levels of dissolved oxygen drop below two to five parts per million. When this occurs, it kills aquatic organisms in large numbers which Pathogens are another type of pollution that prove very harmful. They can cause many illnesses that range from typhoid and



dysentery to minor respiratory and skin diseases. Pathogens include such organisms as bacteria, viruses, and protozoan. These pollutants enter waterways through untreated sewage, storm drains, septic tanks, runoff from farms, and particularly boats that dump sewage. Though microscopic, these pollutants have a tremendous effect evidenced by their ability to cause sickness.

## ADDITIONAL FORMS OF WATER POLLUTION

Three last forms of water pollution exist in the forms of petroleum, radioactive substances, and heat. Petroleum often pollutes waterbodies in the form of oil, resulting from oil spills. The previously mentioned Exxon Valdez is an example of this type of water

pollution. These large-scale accidental discharges of petroleum are an important cause of pollution along shore lines. Besides the supertankers, off-shore drilling operations contribute a large share of pollution. One estimate is that one ton of oil is spilled for every million tons of oil transported. This is equal to about 0.0001 percent. Radioactive substances are produced in the form of waste from nuclear power plants, and from the industrial, medical, and scientific use of radioactive materials. Specific forms of waste are uranium and thorium mining and refining.

The last form of water pollution is heat. Heat is a pollutant because increased temperatures result in the deaths of many aquatic organisms. These decreases in temperatures are caused

when a discharge of cooling water by factories and power plants occurs.

## GROUND WATER

Ninety-five percent of all fresh water on earth is ground water. Ground water is found in natural rock formations. These formations, called aquifers, are a vital natural resource with many uses. Nationally, 53% of the population relies on ground water as a source of drinking water. In rural areas this figure is even higher. Eighty one percent of community water is dependent on ground water. Although the 1992 Section 305(b) State Water Quality Reports indicate that, overall, the Nation's ground water quality is good to excellent, many local areas have experienced significant ground water contamination.

Some examples are leaking underground storage tanks and municipal landfills.

## LEGISLATION

Several forms of legislation have been passed in recent decades to try to control water pollution. In 1970, the Clean Water Act provided 50 billion dollars to cities and states to build wastewater facilities. This has helped control surface water pollution from industrial and municipal sources throughout the United States. When congress passed the Clean Water Act in 1972, states were given primary authority to set their own standards for their water. In addition to these standards, the act required that all state beneficial uses and their criteria must comply with the "fishable and swimmable" goals of the act. This essentially means that state beneficial uses must be able to support aquatic life and recreational use. Because it is impossible to test water for every type of disease-causing organism, states usually look to identify indicator bacteria. One for a example is a bacteria known as fecal coliforms.(Figure 1 shows the quality of water for each every state in the United States, click on the US link). These indicator bacteria

suggest that a certain selection of water may be contaminated with untreated sewage and that other, more dangerous, organisms are present. These legislations are an important part in the fight against water pollution. They are useful in preventing Environmental catastrophes. The graph shows reported pollution incidents since 1989-1994. If stronger legislations existed, perhaps these events would never have occurred. In recent decades to try to control water pollution. In 1970, the Clean Water Act provided 50 billion dollars to cities and states to build wastewater facilities. This has helped control surface water pollution from industrial and municipal sources throughout the United States. When congress passed the Clean Water Act in 1972, states were given primary authority to set their own standards for their water. In addition to these standards, the act required that all state beneficial uses and their criteria must comply with the “fishable and swimmable” goals of the act. This essentially means that state beneficial uses must be able to support aquatic life and recreational use. Because it is impossible to test water for every type of disease-causing organism, states usually look to identify indicator bacteria. One for a example is a bacteria known as fecal coliforms.(Figure 1 shows the quality of water for each every state in the United States, click on the US link). These indicator bacteria suggest that a certain selection of water may be contaminated with untreated sewage and that other, more dangerous, organisms are present. These legislations are an important part in the fight against water pollution. They are useful in preventing Environmental catastrophes. The graph shows reported pollution incidents since 1989-1994. If stronger legislations existed, perhaps these events would never have occurred. urred. urs.