Water, too valuable to waste!

INTER-AMERICAN ASSOCIATION OF SANITARY ENGINEERING

Division of Environmental Health
PAN-AMERICAN HEALTH ORGANIZATION
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CARIBBEAN WATER AND WASTEWATER ASSOCIATION
WATER AND YOUR HEALTH

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Water is critical for sustaining life. As such, the relationship between water and good health cannot be overstated.

This booklet is aimed at secondary school children and is intended to educate them about the importance of water in relation to their health. It answers the basic questions—What is water? Where does it come from? What are some of the contaminants in water? What are the effects of contaminated water to our health? What are some of the water related diseases?
# TABLE OF CONTENTS

- Water: A Valuable Natural Resource  
- Water Sources
- Groundwater—A Hidden Resource
- Groundwater Contaminants
- Surface Water
- Surface Water Contaminants
- Health Effects of Contaminated Water
- Water Related Diseases
- Conclusion
- Activity Sheet
- References
Water: A Valuable Natural Resource

Water, it is all around us. But, where does it come from? If you are like most people, you probably take water and other natural resources for granted and have sometimes misused them. What does water mean to you? If we were to ask three people this question — we are likely to get three different answers as water means different things to different people.

Water is essential for life. Next to oxygen, fresh water is the most important substance for sustaining human life. A human cannot survive for very long without water to drink. Without it, even the healthiest individual will be dead within twenty-four to ninety-six hours.

Our demand for water is great, because it is required for many of our daily activities—for industrial uses, agriculture, domestically for cooking and washing, as well as for drinking and for carrying waste. Because water is such an intricate part of our lives, our ancestors had always revered water as a goddess.

Today, this celebration of the "Inter-American Water Day," provides us with a unique opportunity to focus on the various issues related to water in Latin America and the Caribbean countries. In this overview, we have tried to answer some of the basic questions related
to water. What is water? Where does it come from? What are some of the contaminants in water? What are the effects of contaminated water to our health? What are some of the water related diseases?

**Water Sources**

Water is continually in motion, circulating from oceans, to air, overland, underground and back to the sea. This process is called the "hydrologic or water cycle." There are two water sources: surface water and groundwater. These terms are used to describe where the water is, not to describe different kinds of water. All water comes from precipitation.

Latin America and the Caribbean are very rich in water resources. Although, like many regions, water is not uniformly distributed among the countries however, most of the population has an abundant amount of water to meet its needs. As essential as this natural resource is, it is not well managed and protected in the Region.

In Latin America, the pollution rate is much higher than many other regions. Statistics show that South America pollutes approximately 11 times more freshwater on a per capita basis than Europe. This is not surprising, because only a very small percentage of municipalities in Latin America and the Caribbean adequately treat their sewage before emptying it into natural waterways. ✪
Groundwater
A Hidden Resource

Did you know that two-thirds of the world's fresh water is found underground? In some countries, there is more water underground than on the surface. Groundwater is one of our largest natural resources and is rarely understood by the general public. It represents about 95% of the freshwater on earth. While the water of rivers and lakes (surface water) account for less than 5%. These facts illustrate the importance of groundwater to human life.

What is groundwater? It is very difficult to picture groundwater, because we do not see it, and we know very little about it. When the rain falls, some of the water runs off into streams, some evaporates, some is absorbed by the roots of plants and some penetrates the soil. The water that penetrates deeper, saturates the pore spaces of the ground and forms an underground storage (reservoir), is what is commonly referred to as GROUNDWATER.

Groundwater is an important water source in Latin America and the Caribbean. It is estimated that 50% of the communities in the Region use underground water as their major water source, including some large cities such as Lima, Mexico City and Santiago.

Is groundwater safe? Traditionally, we assumed groundwater was pure, however, it is rapidly threatened with contamination. Both groundwater and surface water can be contaminated. For drinking purposes, groundwater is generally safer than surface water. This is because of the natural purification and filtration processes that takes place in the ground. As water infiltrates the soil, the earth acts as a natural filter and screens out chemicals and bacteria.

However, these processes become ineffective as pollutants seep down to the water table into the ground. Industrialization and agricultural activity, using chemical fertilizers and pesticides have resulted in the contamination of groundwater supplies. In addition, huge increases in population, with many people living close together, have also added to the water pollution problem.
Groundwater Contaminants

Be aware! Groundwater supplies are in danger, these substances can contaminate your groundwater:

- Overuse of pesticides and fertilizer.
- Gasoline leaks from storage tanks.
- Landfill sites and garbage dumps.
- Chemicals and hazardous waste such as cleaning solvents.

Groundwater contamination occurs when pollutants infiltrate the groundwater system. This usually results from the activities of man at the land surface, including inadequate or improper disposal of sewage, and industrial waste.

- The most common source of groundwater pollution is homes with septic systems and cesspools. These systems are considered to be the single greatest source of discharge into the ground. In many areas, the high density of these systems increase the potential of polluting subsurface areas. Contamination of domestic septic tanks with both nitrates and bacteria is a very serious problem in the Region, as wastes seep into the ground from these fields, and cesspools and have caused many productive wells to be abandoned.

- Improper disposal of industrial wastes have resulted in the contamination of some groundwater sources. Many industries have found it convenient to dispose of their wastes into the nearest river. When stream water is polluted by industrial wastes, the pollution can affect the water in adjacent aquifers. This is because some groundwater reservoirs are recharged by seepage from streams.

- When the underground is composed of coarse gravel beds, and fractured rocks, the groundwater itself often carries for long distances sewage solids, bacteria, and viruses, which may be responsible for obnoxious tastes, odors, and other materials that may be a danger to health.

- In rural areas, the wide spread usage of agricultural chemicals, especially nitrates, has been identified as a potential source of groundwater pollution.

Because groundwater is hidden, it is very difficult to know if sources are contaminated or not. It is also difficult to identify the cost associated with groundwater pollution, particularly since in the long term a contaminated aquifer is a condemned aquifer.

Help protect groundwater—Do a little investigating

- Check around your home for substances which could create problems if they were dumped into the sewers or taken to
landfill sites. These would include items like leftover paint, cleaning solvents, old batteries, car oils, rat poison, pesticides, furniture polish, and bleach. Remember these and other hazardous products should not be thrown directly into the trash, because they end up in landfill sites and can leach into the groundwater supplies.

- Check to see how many wells are in your community. Find out what percentage of your water comes from wells.
- Find out if there are cities or areas in your country where sewage is dumped without treatment.

**How Much Water Does the Ground Hold?**

To get an idea of how much water the ground can hold, fill a glass with dry sand. Add water to it. You will be surprised how much water can be stored between grains of sand. Did you know that there is thirty times more water underground than there is on the earth’s service? *
Surface Water

The water that falls on the surface of the Earth and does not enter into the ground, or evaporate, but collects in streams and lakes is called SURFACE WATER. Surface water includes all freshwater on the surface of the Earth; rivers, streams, ponds, lakes, and reservoirs including springs. A spring occurs where groundwater naturally discharges to the surface. Surface water contributes half of the water supplied in Latin America and the Caribbean. The characteristics of surface water sources are:

- Rivers and streams which flow and transport water into the ocean.
- Ponds and lakes are depressions containing water that were formed by natural and man-made activities.
- Catchment systems — can be any surface area that collects runoff during a storm or shower, it might be collected in cisterns, a paved area or a roof that drains into a rain barrel or storage basin.

Latin America has vast resources of rivers and lakes, although they are often not located in densely populated areas. The intensive use of surface water has however, reduced its quality considerably. Surface water is a natural resource and without protection, it can be easily contaminated.

Surface Water Contaminants

The natural quality of surface water is affected by human and industrial activities in the watershed. The Pollutants of surface water can be best categorized into three basic groups: domestic, agricultural and industrial pollutants.

Domestic Contaminants

- Sewage is the major source of water contamination in Latin America and the Caribbean, as many communities are unable to treat their wastewater causing pollution of surface water. Many cities in the Region still dump large amounts of untreated wastes into nearby rivers and seas, which contain bacteria and other organisms.
Pollution of water sources resulting from agricultural activity is very common, since agriculture is the mainstay of many Latin American and Caribbean economies.

That may be harmful to human. This is due in part to the high costs of wastewater treatment. The breakdown of the sewage often takes oxygen from the water, which may endanger fish life.

- Detergents, fertilizers and pesticides may be spilled or washed into the surface water systems. These substances are often harmful to fish and other wildlife. The long range effect on people who eat the fish and drink the water may be harmful.

Agricultural Contaminants

Agricultural pollutants include pesticides, herbicides, and other chemical compounds used in agricultural activity. Pollution of water sources resulting from agricultural activity is very common, since agriculture is the mainstay of many Latin American and Caribbean economies. Pesticides, herbicides, soil, animal waste and nutrients that wash from farmland into nearby surface water can lessen the beneficial use of those resources.

- Pesticides use in agriculture is increasing. Brazil consumes about 150,000 tons annually, ranking it among the top five users in the world. In some areas in the Region, for example, in the Caribbean, fish kills have been found to be related to the heavy use of pesticides used for the culture of bananas.

There seems to be a trend in the Region, whereby, many countries are using chemical fertilizers, in lieu of the traditional fertilizers from animal wastes. The evidence is clear in some Caribbean countries, where the use of chemical fertilizers have already reached levels similar to those in developed countries.
Throughout Latin America, the reuse of irrigation flow for further irrigation adds contaminants to the water. The drainage water from irrigation is usually contaminated with fertilizers and pesticides, and frequently with dissolved salts.

**Industrial Contaminants**

Industrial pollutants are industrial wastes discharged directly by receiving streams, and can include anything from toxic chemicals to raw sewage, some of which are now thought to be carcinogenic, or capable of causing cancer.

The biggest threat to water supplies is still micro-organism, which cause diseases like cholera and typhoid. Today, chemical contaminants in water are a major concern as well and pose a health hazard. Many of these chemicals have been linked to cancer, birth defects, liver and kidney damage.

Unlike groundwater, surface water pollution and contamination is evident to the naked eye, though tests and analysis of the water are still needed.
Health Effects of Drinking Contaminated Water

The human health effects of consuming drinking water containing contaminants can be broken down into two classes: inorganic and organic substances.

Contaminants in water can have acute and chronic effects on our health. Acute effects usually occur shortly after exposure to a hazard, while chronic effects may not appear for a relatively long period of time after exposure. Heavy metals, nitrates, common table salt, calcium etc., all fall under the INORGANIC class.

At low doses, many of these are beneficial to health and are required in small amounts for a healthy life, and can be found in most food as well.

Inorganic Substances

HEAVY METALS—includes lead, mercury, copper, and gold. All can cause illness if ingested in sufficient doses over long periods of time. High concentrations of heavy metals could be found in the water bodies in Latin America and the Caribbean. This is because for many countries in the Region, mining is among the leading industries. Mine drainage and dewatering, mineral tailings and leaching beds, and sediment are the primary causes of water contamination by inorganic, especially heavy metal.
Below are some examples of the health effects that may be related to the mining and processing of ores and minerals:

- In one region in Mexico, many towns had been supplied with groundwater that contained high concentrations of arsenic. This resulted in skin lesions in a relatively high proportion of the population.

- Though gold only represents a small portion of mining activity on a weight basis, from a public health standpoint, it is probably the most serious problem due to indiscriminate use of mercury in the separation process. The major gold producing countries are: Brazil, Chile, Colombia, Dominican Republic, Mexico, and Peru.

- Mercury is used to separate gold, however, much of it is discharged into aquatic environment. There is no solid evidence as to the amount of mercury released from gold mining. However, it is believed to be around 50% of the annual use.

Hazardous levels of mercury are being reported and appears to be rising in fish and mother’s milk. Also cases of neurological effects are increasingly being reported, and are believed to be associated with both exposure to vapors, as well as to food. It is estimated that continued uncontrolled discharge of mercury could affect almost a million people in the affected water basins, and it has the potential to affect far more.

- Nitrate poisoning has been recognized for more than 100 years. Since normal water purification practices do not remove nitrate, tap water has the same intake concentrations as raw water. Nitrate finds its way into water from fertilizers, sewage, and animal wastes because of the mobility and persistence of nitrates in groundwater, there are major health hazards in certain aquifers in Latin American and the Caribbean.

- Sodium is a common element and can enter drinking water supplies through both natural and artificial sources — leaching of underground deposits, and spray from the ocean. The effect of sodium in the diet, especially in drinking water is not conclusive, although, it has been associated with high blood pressure and cardiovascular disease.

Organic Substances

Today, there is anxiety about organic chemical contaminants in our water and whether they pose a health hazard — can they cause cancer, birth defects, or liver and kidney damage?

In general, the sources of ORGANIC contamination, include industrial activities, as well as everyday activities as pest control on lawns and
farmland, cleaning septic tanks and disinfecting water. Most of the organic in raw water comes from natural sources, such as decaying leaves and animal matter.

In Latin America and the Caribbean, relatively little information is available on the various organic chemical substances that are being used and are making their way into water sources. And in those instances where there may be known chemicals, there are no mechanisms in place to monitor their effects.

**Water Related Diseases**

In some countries of Latin America and the Caribbean, water related diseases are everyday occurrences and are among the leading causes of illness and death.

The evidence is overwhelming that man himself often creates much of the environmental conditions that affects him. It is important to understand the mechanisms of transmission of disease to properly evaluate the impact of water and sanitation on health. Water related diseases include the following categories: water-site, water-contact, water-quality and water hygiene diseases.

- **Water-site (vector) diseases** are transmitted by insects which breed in or near water habitat. The insects that carry them are—tsetse flies, black flies and mosquitoes. Transmission occurs when the insect becomes infected with the disease organism from biting someone or an animal, and then bites another person. The insects breed in water that is used as water supplies (streams, rivers), and in the case of mosquitoes in water storage jars. The diseases in this class includes: malaria, african trypanosomiasis (sleeping sickness), and argoviruses (yellow fever and dengue).

Probable the most common of these diseases in the Region is malaria. Wherever the disease is endemic, it is considered to be one of the most serious health problems. The risk of malaria is usually greatest in all countries in the Region that are actively promoting economic development projects through the agricultural settlement of new lands, the construction of dams, and highways, thus, bringing immigrants and workers to these areas. This usually creates conditions conducive for the spread of diseases, particularly since living conditions may be precarious.

For example, Brazil, which had seen a drastic reduction in malaria cases by the 1970's saw a marked increase in the number of reported cases by 1989. The increase in numbers of the cases came from the Amazon Region, where extensive
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Mining and forest exploitation had resulted in rapid immigration of non-immune people from malaria-free areas. Eventually, the immigrants returned to their homes, unfortunately, this resulted in them reintroducing the infection into areas previously cleared of malaria.

- **Water contact diseases** are transmitted when people have contact with infected water. The most important of these diseases is SCHISTOSOMIASIS (blood fluke disease). In recent years, the incidence and prevalence of schistosomiasis has decreased in some parts of the Region, while in others, this endemic parasitic disease has become more widespread. In 1990, it was estimated that of the possible 32 million people at risk in the Americas, 30 million were in Brazil and the rest in Venezuela and the islands of the Caribbean.

Schistosomiasis is transmitted by the combination of man, water, sanitation and snails. An infected person urinates or defecates in or near water. Schistosome eggs in human excreta hatch on reaching the water, parasites enter snail (vector) and develop to infectious stage. The parasites expelled by snails swimming freely and penetrates the human skin. While much of the exposure of schistosome is occupational for agricultural workers in rural areas, and fishermen, many if not the majority, of infections are through exposure of women and children during bathing, laundering, drawing water, and other domestic activities.

- **Water quality diseases** are those diseases that are largely associated with inadequate sanitary protection as a result of which pathogenic organisms, which are always present in domestic sewage, are ingested. Ingestion occurs mostly either directly from drinking contaminated water, or indirectly
from the consumption of crops, such as raw vegetables that have been irrigated with contaminated water. Two well-known “water-borne” diseases are diarrheal and cholera.

- Diarrheal disease— is one of the most important health problems that affect the children population and in some parts of the Region, is among the first five causes of death in young children. In several countries of the Region gastroenteritis and diarrheal diseases are responsible for about 250,000 deaths per year among children and adults excluding death from typhoid fever and hepatitis.

- Cholera—In January 1991, an outbreak of cholera occurred in Peru and reached epidemic proportions in Latin America from Chile to Mexico. Cholera is an intestinal disease characterized by dehydration, acid build-up and circulatory collapse. Cholera may be transmitted either from active cases or from carriers. All that is necessary, in both instance, is that food and water be contaminated and then ingested.

- Water hygienic diseases may result from a lack of, or inadequate, clean water for personal and domestic hygiene. The availability of clean water for frequent bathing, hand washing, before meals, after using the toilet, and for laundering of household utensils is important. Most of these hygienic diseases can be transmitted through drinking water, but their major vehicle of transmission is through food, and hand-to-mouth contact. Shigellosis, salmonellosis (food poisoning),
trachoma (rough eye) and scabies, are some of the most common water hygienic diseases, and can be passed by direct contact between people or by the direct contamination of food by dirty hands.

**Water hygienic diseases can be transmitted:**

- When there is an inadequate supply of water to meet peoples' daily needs or when the water supply is located at a distance from the users. The availability of only small amounts of water makes the practice of good personal and household hygiene difficult, or even impossible.

- When food contaminated with salmonella bacteria is eaten, and results in food-poisoning diarrhea which can be life-threatening, especially for small children.

- When people do not bathe frequently or use the same water and towels to wash more than one person, then trachoma can be passed around within a family or other groups living together and scabies get passed from the skin of one person to the skin of another.

Many water-borne diseases can be limited in occurrence, or prevented all together. All that is necessary is that:

- People prevent the contamination of water sources, by adequately treating water intended for consumption and domestic use;

- Individuals practice basic personal hygiene—this is an important part of disease prevention.

It has been shown that improvement in water supplies, and intervention play an important role in the eradication or prevention of many of water related diseases, particularly those originating from faecal oral contamination, such as diarrhoeal diseases and infectious hepatitis, and cholera. *
In conclusion

The importance of protecting and preserving our water resource cannot be over-stated. Water conservation has, therefore, become a major issue in the fight to save the environment.

The increasing demands being placed on water resources have put a strain on finite supplies. Thus, water conservation is an attempt to save and/or reduce water use where appropriate, and make optimum use of our water resources. There is clear evidence that contamination of water resources continue to increase. The preservation of water quality must be establish as a priority for Latin America and the Caribbean if biological pollution of water resources is to be reduced as well as the level of water related diseases. More over these problems if not properly controlled, are likely to get worse with the expansion of water and sewerage services to meet the demand of the fast increasing urban population. *
ACTIVITY SHEET

Be Informed About the Water in Your Community

Where does your water supply come from? Where does it go after use? Are there some things that go down your drain into the sewer that should not? How is the wastewater treated in your community (if at all)? Does your community have a storm sewer? Where does it empty?

Then learn more about the wastewater treatment in your community. If there is a waste treatment plant, ask your teacher to arrange a visit. Or if your community uses septic tanks, have a speaker come in to your school to describe how septic tanks work.

IN CLASS — List your family’s use of water for the first hour of the morning, all the ways your family wastes water, then discuss as a group how you and your family can conserve water in your home.
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