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Water, Promises and Problems

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Introduction

My curriculum unit will examine a relevant topic in the broad spectrum of environmental issues, water. It is a prime ingredient for everyone's life. It is an essential part of many industries. It is an integral part of numerous recreational activities. It is not something we can find a substitute for and yet, it has been taken for granted by most of us. Our present standard of living in the United States continually increases its demand for this valuable liquid. This unit is applicable for any grade level. It could be used for a minimum of three weeks.

Some pertinent facts are relevant to this unit. Water covers more than 70 percent of the earth's surface. It makes up a major portion of the weight of all living things. The human body is between 65—70 percent water by weight. Also, each person uses an average of 150 gallons per day.

To begin a curriculum unit on water it is appropriate to see where and how we obtain our supply. This valuable resource is the product of the hydrologic cycle. This natural phenomenon enables water to continually be recycled providing we do not alter this process too often. There is not a beginning or an end to the cycle unless our gluttonous demands or destructive habits seriously affect its pattern.

On the following page is a simplified drawing of our invaluable producer.

If this habitual process was generally left intact, there would be fewer problems. However, the difficulties arise when we use too much or we impair the quality by adding foreign substance or pollutants. Also, we disturb the cycle's evolution with buildings or elimination of vegetation. The problems of quantity can usually be handled in a technological age by altering our distribution patterns and reducing our consumption. The quality issue is another problem. Since it is a chemical compound we can only change it slightly before it is no longer useful for many of its primary purposes.

(figure available in print form)

Although our water is continually recycled there are various suppliers of this commodity. Throughout the United States there are numerous water companies which are charged with the essential task of delivering water to millions of customers. This substance is used for any number of reasons from brushing your teeth to cooling large machines in industrial complexes. Besides the water companies, many people and businesses

obtain their water from an alternate supply. In rural and suburban areas private citizens often have wells. Other industrial operations may tie into a river, stream, lake or even ocean to receive their supply. For example, the New Haven United Illuminating Company has a large power station adjoining the New Haven Harbor. They receive part of the water needed to operate this generating station from the New Haven Water Company. Also, they use some of the Long Island Sound salt water as a cooling agent. Sometimes water must be transported hundreds of miles because a particular area lacks an adequate supply. A case in point would be Southern California which has a minimal supply and must get their water through a series of pipes and dams. The Rocky Mountain States or the Far Western States have one river which helps seven states and another country with their needs. The Colorado River aids Wyoming, Arizona, Colorado, Nevada, Utah, New Mexico, California and Mexico.

The water supply dilemma has three controversial issues. First it is a problem of wasteful habits rather than scarcity. Secondly, usage does not exceed our supply, but the distribution networks creates some havoc. And lastly and always a controversy in natural resource allocation, who should control; the politics of the subject.

In the United States we have an adequate supply of water. We have approximately 30 percent of the world supply with 6 percent of the population. This is considered an adequate fresh water supply. There are a few problem areas, notably the Far West. Often people think any shortage develops from individual consumers. We take too many showers, wash clothes too often and water our land unnecessarily. However, when there are sporadic shortages, these habits do not seriously deplete the supply. The real culprit is the enormous amounts used by industrial and agricultural concerns. Agriculture uses 47 percent and industry uses 43 percent of our total consumption. In addition, with the current energy problems, industry may be forced to increase their consumption as we change our energy sources. Besides that, the Rocky Mountain area is a potential bonanza for several alternative energy types which need enormous water supplies. The difficulty is the Far West does not have the valuable liquid resource which makes oil shale, geothermal, nuclear and byproducts of coal viable substitutes for petroleum and natural gas. To give a few examples of industrial consumption; 300,000 gallons of water are used to produce one ton of steel, 4,000 gallons of water are necessary to produce one pound of beef and 200 gallons are used to produce one pound of synthetic rubber. On the other hand, a shower or a bath could use a little more than 30 gallons, a dishwasher 15 gallons per use and a washing machine approximately 40 gallons per load.

The second controversy is tangled with the third issue. So I will discuss them as one. Usage does not exceed supply but distribution of water is a major issue. Now anytime a problem is interstate or international in scope, it certainly will raise havoc. To reiterate the Colorado River helps seven states and Mexico with their water needs. Each state has a separate government hierarchy, including utility commissioners, state statutes, state representatives, national representatives, local ordinances and water companies. If you multiply all those interest groups times seven plus a foreign government with all their vested interests; you can only imagine the legal and private hassles that are continually being negotiated in one form or another. Then as another example of the problems encountered in this field you can mention the Tennessee Valley Authority. This quasi-government agency plays an integral part with the water problems of several Southeastern states in addition to the energy supply. (With the hydropower produced) Let me not end this discussion without mentioning an ever present issue in this tangled web of controversy. Each government representative is concerned with not only water, but how will the finances be distributed. The massive construction projects to alter the water distribution network and supply their constituents with not only water but jobs and revenues to please the proper people. There has been more than one monetary crisis and there will continue to be many more in the future in the never ending battle for this valuable indestructible commodity.

The quantity question can be examined from a world perspective down to a local and regional view. In some areas of the world many countries are so dependent on their foreign neighbors that it is surprising that there has not been many armed conflicts over this essential ingredient. Countries in close proximity often could disrupt the supply of many of their neighbors without too much effort. The European continent would be one prime example as countries closely border each other and their water reserves could easily be disrupted.

In other parts of the world there is not enough water to sustain the population. The particular government has had to seek alternatives to their problem. One case in point is Hong Kong. It is a building foreign trade center without enough fresh water to supply its population. They have one of the largest desalination plants in the world. It supplies the area with close to 50 million gallons of fresh water per day. Israel is another country where their very survival is threatened by the lack of fresh water. They have opted for desalination of ocean water. Ultimately, many more countries will be forced to tap the massive supply of ocean water. After all 97 percent of the world's water is salted and thus not suitable for most of our needs. Many times it is disheartening to say the least when we have supply problems and we know the earth's surface is more than 70 percent water, but most of it unusable. Two well known countries each have 20 percent of the world's fresh water supply. Those countries are Canada and Russia.

In this regional area, the Northeastern United States, there are numerous situations. This past year has been a difficult one for Northern New Jersey and the metropolitan New York area. Early in the spring of 1981 they had serious drought problems which forced the water companies to restrict consumers consumption. In certain parts of Connecticut they had supply problems, also. Water shortages were critical in towns such as Greenwich, Stamford, New Canaan, Norwalk, Darien and Manchester. In many of the Southwestern Connecticut towns mentioned they have not had the long range planning that anticipated the increased population and the tremendous industrial growth. No new reservoirs have been added and yet the demand has grown by leaps and bounds. In Greenwich the Bargh Reservoir was 50 feet below normal and at about six percent of capacity. On the other hand, two urban water companies, Bridgeport Hydraulic serving customers in 12 towns and New Haven Water also serving 12 towns, never had a problem. Both of these companies would like to think that their sound planning has enabled them to handle any problems. In the New Haven area the average person uses 141 gallons per day. The average daily amount of water used totals approximately 60 million gallons. It breaks down to only a certain part of the year when this area has a supply greater than the use. It is approximately five months of the year. The New Haven Water Company alone has 17 reservoirs. This job of storing water also included maintaining proper vegetation and forestland for the property adjacent to reservoirs.

We have examined the quantity and supply topic, now let's turn our attention to the other critical issue, the quality of water. This is an issue that has steadily grown with our increasing demand for water in our booming industries and technological age. Although we are in the throes of an economic recession, our demand for water is still increasing and throughout the world other countries are blossoming with the contingent need for water as they add industry and modern technology. Many developing countries in Africa, Asia and South America are experiencing the growing pains of technology and all the accompanying problems including water quantity and quality.

Water is a chemical compound. It is the most abundant compound on the earth. Chemically it is made up of two parts hydrogen and one part oxygen. These are generally known facts and any science text will usually have at least one section explaining and illustrating the electrolysis experiment. The student would be able to separate the compound into the gases and then test for each one with the wood splints. This discussion will center around the recent controversies of the last twenty years. I would recommend beginning the quality of

water topic by getting a commercial water sampling kit of some kind and doing several experiments. The water samples could be from different students' homes, school faucets, the school pool if available, a local pond or river and in this area, the New Haven Harbor. Also, many of the companies will supply water samples to demonstrate specific water types. After doing these experiments as a foundation, the water pollution segment could begin.

Pollution, as many environmentalists say is a byproduct of our way of life. It can never be entirely eliminated from the modern industrial age. However, for many years during our booming industrial and technological development the environment was thought of as a vast supply of natural resources that should be tapped wherever, however and whatever way necessary. By the 1960's public concern began growing rapidly with the deterioration of our surroundings especially lakes, rivers and oceans. In the Eastern and Midwestern states where industry flourished many rivers, lakes and streams were ruined. The public outcry reached Congress and two important laws were passed. The first one in 1972 restricted the pollution of water sources from city sewage industrial chemicals, farm pesticides, fertilizers and other contaminants. These regulations came under the control of the Environmental Protection Agency. Also, the Water Pollution Control Act stated that water should be brought up to a standard of swimmable and fishable quality by 1983. The other law in 1974 authorized the EPA to set up national drinking water regulations that state governments would supervise and enforce. It calls for all public water supplies to be monitored and tested constantly and for the public to be notified if anything goes wrong. The quality standards depend upon the use of the water. This can vary from drinking and cooking to bathing, recreational and various industrial uses. There are a number of conventional checks that are done. They are the pH measurement which is essentially a measurement of the activity of acids and bases in water, oil and grease spills and sewage discharge or waste. Also, the water must be checked for carbon dioxide, dissolved oxygen, other organisms and simple tests such as odor, taste and turbidity which tells us if there is a lot of fine particulate materials present.

The oil and grease spills have had some devastating effects in recent years. With the increase of world petroleum consumption there has been more and more large tankers at sea and consequently more accidents. The oil has destroyed many forms of wildlife and also seriously impaired the recreational and resort facilities of many beach communities. The discharge problem and the subsequent ruination of many local rivers, lakes, streams and harbor areas has been a careless, selfish, economic act. Only recently has the trend been reversed. Three other problems have recently gained a great deal of notoriety. One is thermal-pollution which is caused when heated water used to cool a nuclear reactor is discharged into a formerly cooler water area. This may be fatal to living organisms. Another one is the toxic waste problem which cannot only affect the water but the air as well. Lately it has been disclosed that many chemical companies have been storing toxic waste material near ground water supplies and other potentially dangerous areas. Last but not least is the problem of acid rain. This is the result of coal and oil fired power plants, vehicles and other industrial sources. When rain falls, it attaches to the industrial pollutants releasing dangerous sulfur dioxide and nitrogen oxides into the air and eventually into our water supplies. In New York state in some Adirondack Mountain lakes, the fish have disappeared. Also, it strips plants of their waxy coating—baring the leaves to pests and diseases. It ruins the soil and leaves toxic waste in ground water.

Another pertinent topic would be the recreational aspects of water. There are thousands of people that use the water as their main recreational area. Especially this is true in the Southern part of the United States and the West Coast meccas, California and Hawaii. Lately, some new activities have sprung up in different parts of the country. They include white water rafting on some of the large rivers. Probably the most glamorous sport in the Far West is surfing. Throughout the world swimming and boating are the basic activities. Fishing is a conglomerate activity. Often times it is an industrial activity and other times it is purely recreational. Also,

another activity is canoeing. It has become more popular in recent years. An important foundation for most of the activities is learning to swim. In some cases it is a necessity for safety. However, it is also essential that the water is relatively clean. Each state must monitor public pools, lakes and ocean areas by water for bacteria content and other contaminating pollutants. In Connecticut, the state very carefully monitors each state park and all of the beaches are scrutinized by the local agencies. An example in this area is Lighthouse Park which sporadically must be closed to swimming due to contaminants in the water. Recently the state, in checking the fish in the Housatonic River found a dangerous level of toxic waste. These are two areas which are constantly under scrutiny. Water's availability is something that must not be taken for granted. If properly maintained it is a wonderful resource; but, we must be alert to the terrible consequences of a diminished quality supply.

Now the question arises—will we run out of water for our specific needs? As we demand more and more of this liquid, we will have to speed up the processes of purifying our water. With the added burden of increasing population, the pressure on our water supply will grow. The government agencies such as the EPA will be charged with more and more responsibility. We will all have to be vigilant in protecting a very valuable resource. It is not an easy task as economic concerns come into conflict with safety standards. The future will be more expensive as each of our natural resources becomes more scarce. We will have to compromise when it is necessary but not to jeopardize the health of future generations. Water is a precious resource. It should always be a high priority to keep a constant quality supply. If we waiver from this strategic demand, it would be costly to our very existence.

WATER FACT SHEET

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1. Earth's water supply:
97% salt water
1% icebergs North Pole and South Pole
1% fresh water
2. Breakdown of consumption in the U.S.
43% industry
47% agriculture
9% human physical and domestic use
3. Breakdown of water weight:
50-70% meat
90% milk
35% bread
4. Personal use—Common domestic uses:
Shower 5-6 gallons per minute
Toilet 5-6 gallons per flush
Tub bath 36 gallons.
Dish washer 15 gallons per time
Clothes washer 35-50 gallons per load
Brushing teeth 8 gallons per brush

CLASSROOM ACTIVITIES OR HOMEWORK

1. List as many uses for water as possible: Separate the list with three headings a minimum of six to each group.

Personal Industrial Agricultural

ex. brushing teeth

2. Assignment:

How much water is used by your family per day?

Hints: Check the *Water Fact Sheet-Personal Use* .

How many people in the family? _____

How many showers per day? _____

How many baths per day? _____

How many loads of clothes? _____

How many times per day dishes are washed? _____

Hint: Use a water and a 1/2 gallon container (milk, juice or soda container). How long does it take to fill up the container? If it takes 30 seconds, then multiply the time the water is on by 1/2 and that gives you approximately how many gallons of water is used for each activity. Total the different activities and add them to find approximately how much water is used per day.

3. Assignment—Conservation Day:

How can a family reduce or conserve?

Use the consumption figures and see how many different tasks are necessary. How many can be eliminated? How many can reduce consumption?

4. *Water Sample* Kit:

Variety of kinds on the market.

Some examples of the kits.

1. Biological water pollution
   Test kit -
   Scott Scientific Inc.
   Fort Collins, Colorado 80521
2. La Motte Chemical Educational Products Division Chestertown, Maryland 21620

Use the kit to test some different samples. Some samples could be from the Long Wharf school water fountain, home faucets and school pool or school faucets.

Bibliography

The New Haven Water Company offers some material including the following:

1. Clean Water and Your Health.

2. The Water We Use

3. The Arthur L. Corbin Jr. Water Treatment Plant

4. The Story of Water Supply (cartoon comic)

5. Also, there are quire a few bill inserts. One recent insert is entitled “Is There a Water Shortage?”

Generally all of the pamphlets are informational.

The topic is constantly in the newspapers and periodicals. I found material in the following papers and periodicals.

1. New York Times

2. Bridgeport Post

3. New Haven Register

4. Boston Globe

5. Time

6. Newsweek

7. U.S. News & World Report

8. Forbes

9. Science News

10. National Wildlife

11. Earth Science

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