COURSE CODE: PGD002

**COURSE NAME: POST GRADUATE DIPLOMA IN WATER HYGIENE AND SANITATION WASH Monthly**

Assignment 3

By Vakhtang Kochoradze 31.10.2018

1. Explain six major non-domestic use of water.

Non Domestic water use accounts to nearly 40% of all water utility outputs (Renzetti, 2015). However, water shortages due to global warming, inefficient water use and increased demand from industries and commerce (growing energy demand, bottled water use, etc), has placed non domestic water use in the spotlight (ibid). We distinguish between six major non domestic water uses:

Irrigation – Water use for irrigation makes up to 70% of all water use in the world (WASH Module 3 Notes). What is more, due to increasing food demand, food production needs to increase by another 70% by 2050 (Long, 2016). Such challenges imply improved irrigation techniques (such as drip irrigation systems) that are adopted to water scarcity and drier lands (Bogdanski, 2016). However, the techniques vary from different technologies to depending on what is being grown (WASH Module 3 Notes). As water shortages is becoming more and more common in many parts of the world, new dimensions are created, such as Climate Smart Agriculture, which advocated for adaptive measures of water efficiency through conserving water (Long 2016).

Industrial Water – Almost all production uses water. It can be used in the production process, such as for cooling, boiling, cleaning, etc. or be part of the product it self, for example bottled water (WASH Module 3 Notes). The water is drawn from either the main supply (piped water) or from ground sources (ibid). However, such narrative also includes the notion of virtual water, which implies the amount of water used/embedded in a certain product that is prepared for trade (Lillywhite, 2010). An example would be how many cubic meters of water to produce one metric tonne of apples is used and traded, and how is it accounted for.

Mining – Water use in mining can be considered also as an industrial water, as the use of water is used to clean, process, extract the minerals (WASH Module 3 Notes), however, there are some distinctive features in the water use in mining that sets the sector apart from other industrial water uses. First and foremost, the sector can become a water supplier as well as the largest water user and therefore is often regulated separately from water supply utilities (Prosser et. al., 2011). As mines rely on their own infrastructure, the impact on water ecosystems is very high, that can affect downstream inhabitants in a grave manner (CENN, 2015).

Water and Power Generation – Water is used to generate electricy through Hydro Power Plants (HPP) (WASH Module 3 Notes). It is considered one of the most sustainable ways of producing electricity. However, long term implications of such projects must be considered, as diverting water channels to the HPPs have an impact on ecosystems as a whole, which can have many direct and indirect effects on the environment and fresh water as well. A thorough Environmental Impact Assessment must be developed, including feasibility studies before such projects are implemented.

Aquacultural use – Water used in fish farming (WASH Module 3 Notes). However, such farms require good quality water and in high quantities. The water supply demand is dependent on the types of sea animals held in the farms (Boyed, 2005).

Recreational Use – Recreational water usage accounts for less than 1% of global water consumption (Kibona, 2009). Water is used for leisure activities as swimming, rafting or other similar activities, or irrigating football or gold fields for example.

1. Briefly describe the important roles that water plays in the human body.

A human’s body weight is approximately 60 percent water. Body temperature is regulated and other bodily functions are sustained by utilizing water in the body’s organs, tissues and cells. The amount of water necessary for a body to properly function depends on a multitude of factors, including the climate, illness or any other health problems, and physical activity. It is crucial to rehydrate the body by drinking fluids and eating foods that contain water, as the body loses water through sweating, digestion and breathing. Water is an essential nutrient that is crucial to maintain bodily functions on a daily basis as well as to facilitate the transportation system of the body. It is the medium by which all other essential nutrients are distributed to every part of the body.

**Water Prevents Dehydration**

A body loses fluids by sweating excessively, vigorously exercising, or contracting an illness that results in a fever, diarrhoea, or vomiting. Fluids are also lost due to urinating, which accounts for three quarters of the body’s water loss. If urine is not expelled regularly, toxins build up that negatively affect body health. In this case, it is crucial to increase fluid intake so that the body can restore its natural hydration levels. A doctor might also recommend drinking more fluids to help treat other health conditions, such as blood clots, kidney stones and bladder infections (Lieberman, 2007).

**Water Aids in Digestion**

Water is present in the body’s saliva, mucus and digestive fluids. Water in saliva acts as a lubricant to swallow food which aids in digestion. Digestion depends on enzymes found in saliva to help break down liquid and food and to dissolve minerals and other nutrients. Important nutrients and minerals are more accessible to the body through proper digestion. Water is also necessary to help the body digest soluble fibre. This fibre dissolves easily and benefits the body’s bowel health by producing soft stools that are easy to pass.

**Water Helps Remove Waste**

Drinking plenty of water aids in the body’s proper bowel function. Adequate water intake enables the body to excrete waste through perspiration, urination, and defecation. The kidneys and liver use it to help flush out waste, as do the intestines. Water can also prevent constipation by softening the stools and move digested food through the intestinal tract, as well as reduce the risk of colon and bladder cancer by diluting cancer causing agents in the urine.

**Water Protects the Body’s Joints, Spinal Cord, and Tissues**

Water keeps the body’s tissues moist as well as quench the body’s thirst and regulates body temperature. Keeping the body hydrated helps build muscles and retain optimal levels of moisture in sensitive areas such as the eyes, nose, and mouth as well as in the blood, bones, and brain (Manz, Wentz, Sichert-Hellert, 2002). Furthermore, water helps protect the spinal cord, and it acts as a lubricant and cushion for the body’s joints to keep them healthy and strong.

**How Much Water is Necessary?**

Daily necessary water intake really depends on a person’s lifestyle. For example, a person who spends eight hours or more working in an air-conditioned office will not lose as much bodily fluids as a person engaged in physically rigorous outdoor work. Many individuals meet their daily hydration needs by simply drinking water when they are thirsty, according to a report on nutrient recommendations from the Institute of Medicine of the National Academies (Dietary Reference Intakes, 2006). In fact, most people who are in good physical health get enough fluids by drinking water and other beverages when they are thirsty, and also by drinking a beverage with each of their meals. In general, a human body requires about 1-2 litres of water on a daily basis (Dietary Reference Intakes, 2006). When in doubt, looking at the colour of one’s urine is a good indication of whether or not one is dehydrated. If it's clear, you're in good shape. If it's dark, you're probably dehydrated. A clear colour indicates a body that is well-hydrated, while a dark color indicates a dehydrated body that requires more water.

3. List the types of people who are most vulnerable to waterborne diseases. Explain your answers why and how to overcome the diseases.

**Introduction**

Only 2.5% of the world’s water is actually drinkable, and two thirds of this water is ice in the Arctic and Greenland, leaving only two thirds of the world’s fresh water accessible for human use (WHO/UNICEF, 2000). There is over 7 billion people on Earth. This indicates how little water there is for such a massive global population. We use nearly 30% of the world’s accessible renewal supply of water. By 2025, this value will increase to 70%. Millions of people die each year from waterborne diseases. Water can become contaminated by naturally occurring chemicals and minerals such as arsenic and radon and local agricultural practices, malfunctioning wastewater treatment systems, and other sources can also contaminate safe drinking water (Centers for Disease Control and Prevention, 2018). There is a rapidly growing drinking water issue all over the world with people dying from contaminated drinking water and having no access to water at all, but fortunately, there are some solutions to this global water crisis.

**What Are Waterborne Diseases?**

Waterborne diseases are caused by pathogenic microorganisms that most commonly are transmitted in contaminated fresh water. Infection commonly results during bathing, washing, drinking, in the preparation of food, or the consumption of food thus infected. Various forms of waterborne diarrheal disease probably are the most prominent examples, and affect mainly children in developing countries; according to the World Health Organization, such diseases account for an estimated 4.1% of the total Disability Adjusted Life Years (DALY) global burden of disease, and cause about 1.8 million human deaths annually (WHO/UNICEF, 2000). Some of the most prevalent waterborne diseases include: diarrhoea, cholera, malaria, Japanese Encephalitis, and Filariasis (Centers for Disease Control and Prevention, 2018). The aforementioned diseases are the most common waterborne diseases in India and other developing countries. Poorer populations have daily contact with this contaminated water and, as a result, waterborne diseases are rampant in the developing world.

**Who are the Most Vulnerable to Waterborne Diseases?**

In developing countries, four-fifths of all illnesses are caused by waterborne diseases, with diarrhoea being the leading cause of death among children. The global picture of health and water has a strong local dimension for approximately 1.1 billion people who still lack access to improved drinking water sources. Around 2.4 billion people on Earth have inadequate sanitation (WHO/UNICEF, 2000). There is strong evidence that sanitation, water and hygiene-related diseases account for around 2,223,000 deaths each year, as well as an annual loss of 82,196,000 Disability Adjusted Life Years (DALY).

The World Health Organization estimates indicate that worldwide, more than 2 billion people are infected with schistosomes and soil-transmitted helminthes. Approximately 300 million people experience serious illness due to this fact (WHO/UNICEF, 2000). Malaria, for example, kills more than a million people every single year and a large percentage of them are under the age of five - mainly in Africa south of the Sahara. In the year 2001, the estimated global burden of malaria amounted to 42.3 million DALY's, constituting 10% of the overall disease burden in Africa (Sawka, Cheuvront, Carter III, 2005). Malaria causes at least 396.8 million instances of acute illness every year. Pregnant women are the main adult group at risk. As one of the major public health issues in tropical countries, it has been claimed that malaria has reduced economic growth in African countries by 1.3% every year for the past three decades.

Approximately 246.7 million people around the world are infected by schistomiasis and of this population, 20 million people experience the consequences of the infection, while 120 million people experience symptoms that are milder (WHO/UNICEF, 2000). An estimated 80% of transmission happens in Africa, south of the Sahara. Diarrhoea occurs around the world and causes 4% of all deaths and 5% of the health loss due to disability. Bangladesh alone finds around 35 million people being exposed on a daily basis to elevated levels of arsenic in the water they drink, which will eventually threaten their health while shortening their life expectancy (WHO/UNICEF, 2000).

**Transmission of Waterborne Diseases**

Waterborne diseases spread by contaminating drinking water systems with feces and urine of infected animals or people. The spread of contaminated water is likely to happen where private and public drinking systems get their water such as surface waters - creeks, rivers, lakes, and rain. These sources of water may be contaminated by infected animals or people.

Runoff from sewer pipes, septic fields, landfills, and industrial or residential developments may also spread contamination, which has been the cause of a number of dramatic outbreaks of fecal-oral diseases such as typhoid or cholera (Sawka, Cheuvront, Carter III, 2005). There are a number of additional ways in which fecal material may reach a person's mouth such as in food that is contaminated, or the person's hands. Generally, food that is contaminated is the one most common way people become infected. The germs in feces may cause the diseases by even slight contact and transfer. The contamination might happen because of floodwaters, septic fields, water runoff from landfills, and sewer pipes.

**Preventing Waterborne Diseases**

There are many actions that can be taken to prevent waterborne diseases. To start, the basic human right to water should be fully acknowledged and made a top international priority. One way to stop the continued transmission of waterborne diseases is to improve the hygienic behaviour of people and provide them with basic needs such as sanitation, clean drinking water, bathing facilities, and washing facilities. Clean water is a prerequisite for reducing the spread of waterborne diseases. It is well recognized that the prevalence of waterborne diseases may be greatly reduced by providing people with safe, sanitary disposal of feces and provision of clean drinking water. Water is disinfected to kill any pathogens that might be present in the water supply and to prevent them from growing again in distribution systems.

Disinfection is then used in order to prevent the growth of pathogenic organisms and to protect people's health. People need clean water and water supply systems. Without disinfection, the risk of waterborne disease increases. The two most common methods of killing microorganisms in the water supply are irradiation with ultraviolet radiation, or oxidation with chemicals like chlorine dioxide or ozone, or chlorine.

1. Suppose that inhabitants of a village obtain water from a spring. What advice would you give to the users about the prevention of contaminants entering the spring?

Understanding the drinking water source characteristics, informal institutions on the community level as well as cultural implications towards water is essential to have safe water sources (unicef, 2012). Analysing water safety plans to see how the water gets to the consumer from the source is an important part of knowing how to address any problems or risks that can be present with preventing contamination of water sources (Bartram et al., 2009). However, when spring protection is necessary, first and foremost, the source should be protected from animals gaining access, other surface waters should not enter the spring, and in case of small Spring sources, a “Springbox must be constructed (WASH Module 3 Notes). However, before any preventive measures are being undertaken, a water analysis must be conducted to ensure that the water is within the government water regulation standards, or if the standards do not exist, within the WHO standards (CENN, 2018). Such tests will ensure the validity of any project to take place. If the test results are within the country and/or WHO standards, only then the project can proceed.

Once the decision of constructing a Springbox is taken, the Spring must be evaluated within the following: what are the community habits, what is the spring debit (output) and how accessible is the spring itself. The community should take part in managing the construction process to enforce a sense of ownership and ensure its safe operation in the future (Fry, 2004).

1. The following are pollution sources. Give two specific pollutants for each source.

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| 1. A residential area: | Nitrates; phosphates |
| 1. A metal plating plant: | Alkali; Oil, Grease; Cyanide |
| 1. Agricultural activities: | Phosphorus; Nitrogen; Nitrates |
| 1. An uncontrolled landfill site: | biogenic elements; E. coli; streptococci |
| 1. Urban surface water run-off | Copper; Zinc |

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