Water Pollution in China

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 **Introduction**

 A high quality of drinking water is essential for a healthy population and a strong management of water utilities is important to ensure continuous safe drinking water (Ye et al., 2015). Water pollution is the contamination of water bodies such as lakes, oceans, rivers, aquifers, and groundwater. Water pollution is one of the leading worldwide causes of deaths and diseases. Three different types of water pollution include point source pollution, nonpoint source pollution, and groundwater pollution. Point source pollution is pollution that comes from a single identifiable source such as a city storm drain. Nonpoint source pollution is pollution that comes from cumulative amounts of contaminants from a large area. An example of nonpoint source pollution is contaminated storm water from parking lots, roads, and highways called urban runoff. Lastly, groundwater pollution is pollution that seeps into the soil and contaminates the aquifer below. Water pollution can lead to cancer and parasitic, viral, bacterial, and protozoal diseases. China has some of the most polluted cities in the world which means that the people living there are at a very high risk for developing diseases caused by water pollution.

**Background**

 According to Miao, Tang, Wong, and Zang (2014), “up to 40% of China’s rivers are seriously polluted” and “20% were so polluted that the water is too toxic to touch.” A large contributor to the pollution is China’s industrial companies. This is evident due to the frequent outbreaks of toxic substances leaked into the lakes and rivers. On average water pollution outbreaks have been occurring every two to three days since 2005 with a total of more than 1,700 water pollution incidents each year. In China, due to diseases caused by water pollution, 60,000 people die and 190 million fall ill every year. The only motivation the companies have for reducing their pollution output is government regulation with community participation and market demand as support. That means that companies are not forced to reduce their pollution output. The only reason they would ever reduce their output would be if there were a law saying they had to or if people in the community stopped purchasing their products until they became more environmentally friendly. Conflicting policies and lack of policy interactions did not allow the previous policies to be effective. In 2014 China finally revised the environmental protection law, but this is still just a starting point in saving China’s environmental health. There are still limitations to the revised environmental protection law such as only organizations above the city level will be able to launch lawsuits, which is only about 300 non-governmental organizations. Another limitation is that “lawsuits are allowed only against polluters but the provisions for actions against enforcement authorities remain murky” (Miao, Tang, Wong, and Zang, 2014).

**Health Implications**

 China not only suffers health effects from bacterial contaminants in the water, but from chemical contaminants as well. Some bacterial contaminants that they are exposed to are E. Coli, cholera, hepatitis A, giardia, Cryptosporidium, and typhoid fever. One of the most common bacterial contaminants that the citizens of China are exposed to is E. coli. E. coli can lead to bloody diarrhea, severe anemia, kidney failure, severe stomach cramps, vomiting. Some infections are mild, but some can be life-threatening. Some chemical contaminants that they are exposed to are carbon dioxide, arsenic, nitrogen, carcinogen benzene, cadmium, mercury, lead, and copper. One of the most common chemical contaminants that they are exposed to is lead. Excess ingestion of lead can lead to lead poisoning. The effects of lead poisoning in children include developmental delay, learning difficulties, irritability, loss of appetite, weight loss, sluggishness and fatigue, abdominal pain, vomiting, constipation, and hearing loss. The effects of lead poisoning in adults includes high blood pressure, abdominal pain, constipation, joint pains, muscle pain, declines in mental functioning, pain, numbness or tingling of the extremities, headache, memory loss, mood disorders, reduced sperm count, abnormal sperm, and miscarriage or premature birth in pregnant women. All of these symptoms are the health effects of only two exposures. Including all of the exposures in the polluted water, there must be hundreds of negative health effects occurring from consuming the contaminated water.

**Methodology**

According to Ye et al. (2015), effective ways to safeguard water supply safety include hazard analysis critical control point (HACCP), qualitative microbial risk assessment (QMRA), and water safety plans (WSP). HACCP is a quality management system that is applied in the food industry to analyze and control chemical, physical, and biological hazards in the production process that can make the final product dangerous. QMRA is a process used for estimating the risk from exposure to microorganisms by combining dose response information for the pathogen with information on the distribution of exposures. WSP are tools for proactive measures to ensure the safety of drinking water using risk assessment and risk management approaches. The goal of a WSP is to minimize contamination of water sources and prevent or remove contamination during treatment, storage, and the distribution of water supplies. The WSP is based on the HACCP concept, but with a special focus on water. QMRA can be used in the WSP system assessment to determine if the treatment is meeting health-based targets with the required level of certainty or not (Ye et al., 2015).

**First supporting case/example**

# An outbreak of hepatitis A associated with a contaminated well in a middle school, Guangxi, China studied the cause of an outbreak of hepatitis A in a middle school in China. The study was conducted in order to identify the cause of the outbreak, the mode of transmission, and to recommend control and prevention methods. They discovered that at the school there were two water sources. One was pipeline water, which was treated, and the other was well water from outside taps, which was not treated (Ye-qing et al., 2012). The well water was also close to a vegetable garden that was fertilized with toilet feces. There were no water facilities or toilets for the boys’ dormitories; therefore, they used the outside well water for bathing, mouthwash, and drinking. The girls and the teachers’ dormitories had water facilities and toilets, but the teachers used well water for cooking and washing (Ye-qing et al., 2012).

# In the study, a case was defined as a person from the school who had onset fatigue, anorexia, abdominal pain, diarrhea, or jaundice between the dates of February 20th and May 20th, 2012, with all other diagnoses excluded (Ye-qing et al., 2012). There was an attack rate of 3.8% for students and 1.5% for teachers. Furthermore, those who used well water were 8.7 times more likely to be ill than those using pipeline water assuming that all male students used well water and all female students used pipeline water. The majority of the cases were male with an attack rate of 6.6% (Ye-qing et al., 2012).

# Ye-qing et al. (2012) concluded that since all students and teachers ate at the same cafeteria, female students and teachers had access to pipeline water, and there was only one teacher case and two female student cases, that a foodborne outbreak was unlikely. The believed cause of the outbreak was contaminated well water; however, they were unable to test the water because the well was closed before they arrived at the school. Their recommendations were to discontinue the use of the well water, that they should all drink boiled water, and that doses of the vaccination should be stored for “controlling outbreaks and for immunizing susceptible populations in future outbreaks” (Ye-qing et al., 2012).

**Second supporting case/example**

In the case study Association between Changing Mortality of Digestive Tract Cancers and Water Pollution: A Case Study in the Huai River Basin, China, it aimed to explore the association between water pollution and the increase of digestive cancer mortality in the Huai River Basin in China. The Huai River Basin is the most worrisome of the seven main river basins in China because of its dense population. In 1970, in the Huai River Basin area, the mortality rate for digestive cancers, except esophageal cancer, was lower than the national average; however, during a study from 2004 to 2006, it was discovered that some counties in the area had an increase in incidence and mortality rates from malignant tumors (Ren et al., 2014).

The research indicated that most of the counties in the northern part of the Huai River Basin suffered from surface water pollution from biochemical oxygen demand, ammonia nitrogen, and chemical oxygen demand. After dividing the area into three sections, the second and third sections had higher changing morbidity. They also found that some counties in the research area had an increase in esophageal cancer mortality rates. And that the county-level changing morbidities “presented similar spatial distributions to those of the FSP indices as a whole” (Ren et al., 2014).

Ren et al. (2014) concluded that the increasing rates of mortality from digestive tract cancers correlated with surface water pollution at the county level with low drinking water safety. They suggested that there should be continuous measures for improving surface water quality, drinking water safety, and that hygienic interventions should be implemented by the local government (Ren et al., 2014).

**Analysis**

 According to Ye et al. (2015), a water system assessment for two water facilities in Beijing, there were 13 hazards or hazardous events in one facility and 12 hazards or hazardous events in the second facility. For the first facility, agricultural fertilization surrounding the water source and not checking the exhaust valve of the water source well were considered medium risks for polluting the water. The risk of livestock defecation around the water source was considered a very high risk for water pollution of the first facility. For the second facility, agricultural fertilization surrounding the water source; lack of data for water sources, treated water, and pipe water; and no health permit for the disinfection of the equipment were considered medium risks for polluting the water. The laboratory analysis of contaminants was considered a very high risk for pollution of the second facility. Risk of other hazards or hazardous events occurring at both facilities were high. The chart below shows the total (bacterial) coliform counts, chemical indicator parameters, and nitrite nitrogen toxicological parameters for each water facility (Ye et al., 2015).

After WPS in both facilities, “compliance percentages of total bacterial counts and total coliform counts were improved by protection of water source and strengthening of water disinfection” (Ye et al., 2015). Nitrate nitrogen was decreased by controlling the chemical contamination from agriculture and chlorine compliance was improved by running disinfection equipment. Furthermore, compliance rates of color and turbidity were improved by improving water source protection and water treatment methods as you can see from the table below (Ye et al., 2015).

**Conclusion**

 Overall, water pollution in China poses a major health threat to the country’s people. The different types of water pollution have caused an increase in mortality from digestive tract cancers and an increase in exposure to many chemical and bacterial contaminants. Unless the environmental protection law is revised again to reduce the amount of pollution being produced by industrial companies, the water treatment process is changed, or the utility management is improved then the water pollution will continue to harm and kill the Chinese people.

References

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