Management of Water Supply Systems in Asian Countries

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Deteriorating water quality and increasing water demand is a significant challenge for water supply systems in many Asian countries. These circumstances necessitate advancements in water treatment technologies and good management practices for efficient water treatment and distribution. The case studies on both surface and groundwater pollution problems discussed below (Tamagawa River, Dau Tieng Reservoir and Saigon River, and Chiang Mai Basin) can help us estimate the future constraints of water supply in these and other Asian countries.

Tamagawa River. Water supply systems have faced and continue to face many challenges in regard to demand and pollution. Tamagawa River in Tokyo has been Japan's only source of water since the mid 17th century. Due to rapid development of residential areas and industries, water quality in this river deteriorated to become an open sewer by 1970. Tamagawa Water Treatment Plant is located downstream of the river, and was eventually closed in the mid 1970s due to the controversy over the quality of the drinking water. It took the residents of Tokyo nearly 30 years to make Tamagawa clean again by constructing sewerage systems in the mid to upstream region. Nevertheless, the people are still skeptical of the quality of water produced by the treatment system. This story illustrates the importance of maintaining public confidence on water quality, because it can be very difficult to win back. A number of water supply systems are facing this challenge.

Dau Tieng Reservoir and Saigon River. Ho Chi Minh City is the largest city in Vietnam with an estimated population of 6 million. Due to economic liberalization, the subsequent growth in foreign investments, and the city's rapid population growth, the demand for water has increased tremendously, while the supply sources are diminishing. The Saigon River is to Ho Chi Minh City what the Tamagawa River is to Tokyo. A new water treatment plant, which was recently constructed in 2004, can only supply water for half of the year due to salt water intrusion from the sea. The Saigon River also finds it difficult to meet the demand for water in the dry season, and the net flow from upstream diminishes to almost zero in the dry months at the intake point. Furthermore, the plant can produce only a half of its total production capacity, i.e., 300,000 m^3/d, due to poor water quality in Saigon River. Water quality deterioration in Saigon River is caused by many activities located mid to upstream. The only large reservoir upstream from the Saigon River is the Dua Tieng Reservoir. This reservoir is not only the source of water supply, but also the location of a number of activities that support the local economy: fishing, sand extraction/exploitation, farming and agriculture, etc. All these activities affect the water quality in Dau Tieng Reservoir, but they were not regulated or monitored in the past. Our research focuses on predicting the future water quality in Dau Tieng Reservoir and Saigon River in order to implement science-based, technically sound policies for water quality management. Now, these activities are monitored using satellite images, which are integrated with water quality monitoring in the reservoir, and interviews with the fish-cage owners and companies that exploit sand. The information that is collected includes: 1) the impact on water quality, such as the number of fish cages and the amount of fish food they put into the cages, 2) demography and health status of the people, 3) economic conditions, such as income, debt, and other sources of income, and 4) their opinions on recent government decisions for a total ban on cage-fishery in the reservoir. This research shows a gradual increase in nutrient levels, which may cause massive algal bloom in the near future.

Once such an event takes place, the Water Treatment Plant faces another difficult problem. However, the combined effects of different activities are not yet well understood.

Chiang Mai Basin. Water resource in Chiang Mai Basin is solely dependent on Ping River. Water quantity of Ping River is not enough to support rapid industrial development of the southern region of the basin, called Lamphun. Because of water quality deterioration and massive growth of water hyacinth, the water company of Lamphun City decided to abstract groundwater instead of surface water. Local people living in the suburbs also use groundwater for drinking, which was found to contain high levels of fluoride. Thai government installed several reverse osmosis (RO) water treatment systems in order to get rid of the fluoride in the groundwater. We made a water quality survey in collaboration with Chiang Mai University to delineate the extent of the fluoride problem and the number of people affected. Both field monitoring data and geological and population distribution date are used to estimate the human health risks associated with high concentrations of fluoride groundwater. Fluoride is currently a problem for many areas in Asian and African countries; UNICEF issued an overview of the fluoride problem in 2002. The precent of the population affected by this problem is not yet known. Our study in the Chiang Mai Basin seeks to estimate the extent of the fluoride problem by collecting GIS data on the effected population, well distribution and other geological data.

Keywords:

Advanced Water Treatment: Usually refers to a water treatment process using ozone and granular activated carbon to remove odor and precursors of disinfection by-products.

Eutrophication: Takes place when excess nutrients, i.e. nitrogen and phosphorus run into water bodies, especially into reservoirs.

THMs, trihalomethanes: Representative disinfection by-products that are produced when chlorine is added into water containing organic matter.

2-MIB (2-methylisoborneol) and Geosmin: Odorous compounds that are detected in raw waters taken from reservoirs laden with algae.