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WATER POLLUTION CONTROL AND MANAGEMENT IN CHINA

Zhu, Xing Xiang*

INTRODUCTION

Since 1979, China has strengthened its control and management of water pollution. In April 1984, the Fifth Session of the Sixth National People's Congress promulgated the "Water Pollution Prevention and Control Law", and the environmental committee of the State Council passed the "Regulation of Water Pollution Control Technology Policy." During the period of the sixth five-year plan, the quality of the nation's surface water has been appraised with cooperation from the departments concerned. In 1986, water resources protection plans were drafted for seven river basins: Chang Jiang (Yangzi), Huang He (Yellow River), Hai He, Zhu Jiang (Pearl River), Sunghua Jiang, Liao He, and Huai He. Water resource protection bureaus or offices have been set up for all seven water basins above mentioned. Since 1983, the Ministry of Water Utilization and Electricity and the Ministry of Construction (MURCEP) practice a double control (the former takes priority) over these organizations. Thus, some experience has been gained in managing rivers according to the river systems and in enhancing the management of monitoring and planning work. During the period of the sixth five-year plan, while the urban population increased and the total industrial output value increased by 65 percent, the total quantity of waste water increased less than 10 percent, and the discharge of waste water per 10,000 yuan RMB of output was reduced from 470 tons to 310 tons. Nevertheless, many problems still remain unsolved in water pollution control management, technology and finance. Water pollution in some places continues to be a very serious problem at present.

DEVELOPMENT AND USAGE OF WATER RESOURCES

China's total quantity of water resources ranks the sixth in the world, but the average amount per person is not big. The

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average river runoff per year is about 2,700 billion cubic meters, and the underground water resource quantity is about 800 billion cubic meters. After deducting for double counting, it is estimated that the total quantity of water resources is 2,800 billion cubic meters, and the average personal consumption per year is only 2,700 cubic meters, which is one quarter of the world average. In China, the main supply of water resources is rain. Average annual precipitation is around 628 millimeters (mm).

Because water resources are not evenly dispersed either geographically or seasonally, the disparity between supply and use can be critical. About half of the land area in China is located within dry or semi-dry areas. In these areas, the precipitation is less than 400 mm. The south part of China has more under-ground water than the north. The underground water in the area south of the Yellow River (Huang He) accounts for about 62 percent of the country's total supply. Rainfalls in most of the areas are very much influenced by the monsoon, and more than 60 percent of the precipitation is concentrated in three or four months every year, mostly from major storms. Rather than being useful, such storm water presents drainage and other problems. All these elements restrict the full use of water resources. To solve such problems, measures should be taken, such as building reservoirs to store rainwater during the season, and constructing facilities to move water from the south to the north.

In the last twenty years, along with urban development and improved living standards, water consumption has doubled in all cities, and the amount increases by 4 percent every year. The present supply can hardly meet existing requirements. Some statistics suggest that the total supply ability of the country is 465.9 billion cubic meters, but the actual supplyable quantity is much less than that number because of the low usage rate of the facilities and continuous drought in the north which has reduced river flows and lowered groundwater tables.

Therefore, it is necessary for the country to make a rational use of the water resources. The development and usage of water resources must now be put within the state plan so as to take all factors into consideration and provide for comprehensive use. Through such planning, we may be able to adjust the supplies between areas and departments using water and thus make efficient use of water resources.

The main problems in water resources usage are that agricultural water consumption is too big (88 percent of total consumption), and industrial water consumption per unit is too high. For instance, when making one ton of steel, modern technology requires 3 to 5 cubic meters of water, while in

China, most steel mills need to use 70 to 100 cubic meters of water; advanced technology for producing one ton of petroleum requires only 0.2 cubic meters of water, while in China 5 to 6 cubic meters or more are needed. Large consumption is the cause of the water supply shortage in 180 cities, according to an investigation of 236 cities in 1982.

In addition, the management structure needs to be reformed. The responsibilities of water supply, use, management and flood control belong to separate departments. Many of these functions overlap and are repetitious, resulting in low efficiency. "The Water Law (draft)" just passed by the National People's Congress will adjust this situation. There are also suggestions to set up water resources administrations on the state, river system, and area levels. The main task of the administrations will be to gather and analyze the basic monitoring information and data, and make decrees and regulations for developing, using, and protecting water resources.

WATER POLLUTION AND ITS HARM

The total quantity of waste water effluent is 34.2 billion tons per year, of which 75 percent is industrial waste water and 25 percent is municipal discharge. About 80 percent of the waste water is discharged directly into water bodies without treatment, thus contaminating 90 percent of the water bodies around cities. For instance, Shanghai's daily effluent discharge is 5 million cubic meters, of which 3.2 million cubic meters were discharged into the Huangpu River, the drinking water source of Shanghai City. Owing to the degradation of water quality in the Huangpu, Shanghai had to spend one billion RMB to get water from the upper reaches.

The water quality of Chang Jiang, Huang He, Sunghua Jiang and Zhu Jiang are comparatively good, owing to the large flows and strong diluting ability. But pollution in some sections of these rivers is very serious. For example, on the mainstream of the Chang Jiang, the total length of 22 polluted sections is more than 400 kilometers. The rivers within Shanghai, Nanjing, Wuhan, Chungqin (daily discharge of over one million cubic meters) and Dukou (daily discharge of 0.5 million cubic meters) have obviously polluted sections. This water pollution causes city drinking water quality degradation. Some sources cannot be used as drinking water. An inspection of 77 water supplies for 31 cities revealed that 44 percent exceed the national standards. The results of an investigation of underground water in 75 cities showed that 41 cities are somewhat contaminated, such as Dayu County of Jiangxi Province which was polluted by heavy metals; Changzhi City of Shanxi Province which was polluted by chemical waste water; and

Suxian of Anhuei Province which was polluted by organic matter. Water pollution increases the gap between supply and demand in the water short North areas. It also has negative effects on industrial production and the quality of products.

The offshore environment also has been polluted as a result of the development of coastal areas. Every year, 1.5 billion tons of household wastes and 4.55 billion tons of industrial waste water are discharged into seas. The development of a vessel disassembly industry has brought about some environmental problems as well. The main pollutants created are waste oil, remaining oil, grease and waste water which is contaminated by oil or other toxic substances. During the disassembly work, oil often escapes to the seas because of the leaks, breaks, fires or explosions. The oil contaminated waste water may contain as much oil as 50,000 mg per liter. Many such factories have no oil separators, so the water and oil are all discharged directly into the seas. The seashore areas around these factories have become contaminated by oil, and the water quality degraded.

Water pollution directly influences industrial and agricultural production, as well as people's health. From 1976 to 1979, there were 571 reported water pollution accidents. Every year, the direct loss to industry from water pollution is more than ten billion RMB. The loss suffered by agriculture and fishing is also startling. The suburbs of Tianjing every year lose one million RMB in agricultural production. In 1985, large areas of water in Qipu County of Shanghai developed a "strange fish-like taste". It was the result of water pollution caused by a nearby chemical factory. Pollution to water sources degrades drinking water quality which endangers people's health. Pollutants in water not only can go into people's bodies directly, but also can be stored up in agricultural products, eggs, fish, and poultry to cause chronic food poisoning.

WATER QUALITY MANAGEMENT

Water pollution control and management have been developed gradually in China. Before 1979, the emphasis was on pollution control. After the Chengdu Meeting in 1979, the emphasis was changed to use management to achieve control. In this field, the "Water Pollution Prevention and Control Law" and "Regulations on Technical Policy for Preventing Water Pollution" were published. Major elements of the "Water Pollution Prevention and Control Law" are as follows:

(1) The responsibilities which imposed on the departments of State Council to water pollution control

The law states that the EPA of the State Council is practicing unified supervision and management of water pol-

lution control. Its main responsibilities are organizing the work of establishing the national water pollution control plan; setting up enforcement and supervision of national water pollution control policies, guiding principles, laws and regulations; coordinating the work of the concerned departments of the State Council and guiding the EPA at the provincial levels, autonomous regions and municipalities directly under the central government. The EPA of local governments are responsible for supervision and management of water pollution control in their jurisdictions. They should carry out national and local guiding principles, policies, laws and standards on water pollution control, supervise the work in their own areas, and coordinate as well as guide water pollution control enforced by departments concerned.

(2) Making national and local standards

The National EPA takes care of making national standards on water quality and on discharge of pollutants, while the people's governments of the provinces, autonomous regions and municipalities directly under the central government have the right to make local standards which are not stipulated by the national standards. The local standards relating to neighboring provinces will be coordinated and adjusted by the environmental protection department of the State Council so as to avoid shifting responsibilities onto each other and to promote the establishment of local standards. Local government may set local discharge standards. When enforcing laws, if there are local standards, the local ones prevail.

3) Designating water resources protection areas

The designation of water resources protection areas is handled by EPA at or above the county level in consultation with the department concerned, and approved by the county or higher government. Transregional areas should be approved by all governments concerned. At present, the emphasis for water protection is to protect drinking water sources. In Beijing for example, the surface water has been designated into three categories. The first category is drinking water sources; the second one is waterbodies in scenic areas; and the third is for all other purposes. In the designated category of water protection areas, no pollutant discharging enterprises are allowed to be established.

(4) Waste water discharge application and registration

The system of application and registration requires that the enterprises which directly or indirectly discharge pollutants into waterbodies must apply to the local EPA and register the category, quantity and concentrations of the pollutants according to the regulations issued by the environmental protection department of the State Council. These enterprises

should also submit the technical information concerning the prevention of water pollution. In doing so, the EPA is able to be aware of the situation so as to strengthen the management and to provide information for policy making.

In order to successfully control water pollution, China will gradually establish the system of discharge licenses according to the provisions of registration of water pollution prevention and control law, allowing the emphasis to shift from qualitative management to quantitative control. Such a system has been used for many years in other countries. In China, the first place to use this system was Shanghai. Since 1986, 108 enterprises have obtained licenses from the city. The discharge quantity from these 108 enterprises is about 95 percent of the total discharges in the upper reach of the Huangpu River. Through the use of the discharge license system, the factories have strengthened the management for preventing water pollution and have increased their sense of responsibility, so that the water pollution in Shanghai has been controlled to a certain degree. Following this example, Xiuzhou, Changzhou and Xiamen also have started to use the system. In July 1987, the state EPA held a meeting in Yantai and decided to adopt the application and registration system for the whole country, and where conditions permit, to practice a license system in some places so as to gain experience.

(5) Impose discharge fees

Enterprises which discharge pollutants to waterbodies should pay discharge fees according to the regulations of the country. If the discharge exceeds the national or local standards, the enterprises should follow the regulations to pay a discharge fee and also is responsible for control. (As the detailed regulations have not yet been published, the work has not been done on a large scale so far.)

To impose a discharge fee is an effective pollution control measure. Before imposing fees, the economic loss caused by discharging pollutants is unfairly shifted onto others, while the polluter may discharge without any legal restrictions and responsibilities. Pollution control funds are provided by the government. Some discharging units still think that pollution control is a problem only for EPA to consider. Use of this new system has changed the situation greatly. For instance, there is a chemical factory in Shanghai which did not pay any attention to harnessing the "three wastes" before. Its waste water, containing fluorine, zinc, oil, acid and alkali, was directly discharged into a nearby river and sewer without treatment. After the fee system was put into effect, EPA monitored the factory and found out that total water discharges per day was 2,800 tons. Thus the discharge fee should be 42,000 RMB per day. The

leaders of the factory were shocked by the amount. They immediately set up waste water treatment facilities. Now apart from flourine, the discharged waste water all meets the standards. Every month, the factory only pays 1,000 RMB.

The fees imposed also provide a fund to help pay for pollution control expenses. According to the state regulation, 80 percent of the fees should be used for enterprises' control work. This fund is controlled by the responsible industry bureau. The remaining 20 percent will be used for environmental protection and EPA's monitoring work.

On November 22, 1986, the Environmental Protection Committee of the State Council published "Regulations on Technical Policy of Water Pollution Prevention". This Regulation is a summation of the past experiences and a guideline for future work. It also adjusts the policy of waste water control as follows:

(1) *To bring water pollution into control according to water systems or areas and gradually practice the system of controlling total amount of pollutants. As to the development and usage of water resources, the policy is "rationally develop; comprehensively use; actively protect and scientifically manage". For the Sunghua Jiang and Liao He water systems, for example, in early 1987, Heilongjiang, Jilin, Liaoning and Inner Mongolia set up a water system lead group to be in charge of solving major water pollution problems.*

The Regulation also strengthens the protection of drinking water sources, designates water source protection areas in which all water polluting projects are forbidden to construct, and allows development of scenic spots only by permit. The Regulation governs underground water usage and pollution prevention as well, because in China, underground water constitutes a major part of the supply for major cities. This is especially true in the North. Beijing, for example, mainly relies on underground water sources. Overuse reduces groundwater levels every year by 0.5-1 meter. Water sources protection, therefore, is imperative.

From August 13 to 15, 1987, the Meeting on Water Resource Policy and Management in Beijing and Tianjing Area was held in Tianjing. Mr. Song Jian, Minister of the State Science Commission, addressed the meeting. He expressed the opinions of Vice Premier Wan Li and Li Peng that water resources are as important as grain. To save water should be a state policy. We should develop the industry and agriculture which need less water. Mr. Song Jian said that we must make laws for water resources management and that a series of policies should be worked out. There was agreement among the 160 experts at the meeting that one of the major issues in water re-

sources management is to reform the management system. The situation of "many dragons regulate rivers" must be changed. To prevent water pollution on a river basin basis paves the way for such reformation.

(2) *To comprehensively control urban waste water.* The Regulation seeks to change the situation from individual control to the development of collective treatment facilities. The construction of waste water treatment facilities normally provides for primary treatment. In the areas where secondary or tertiary treatment is necessary, the necessary treatment technology could be adopted.

The drainage facilities in China are completely inadequate. Drains and sewers cover only 30 to 40 percent of the urban areas, and the waste water treatment rate is less than 3 percent. Now urban industrial output is more than 30 times that in the 1950s and the quantity of effluent has increased by 20 times; at the same time, drainage facilities have only increased by 3 times. In Beijing for example, between 1959 and 1980 the investment for drainage facilities accounted for less than 0.5 percent of the total municipal construction investment. In 1981, the city's effluent discharges were 30 times greater than in 1949, only ten percent of which is given primary treatment. To put the construction of urban sewage drains and waste water treatment facilities into municipal comprehensive control plans and construction plans is a pressing matter and a formidable task.

In order to comprehensively control urban waste water and to encourage the treatment of industrial waste water together with municipal waste water, the Regulation stipulates that so long as the waste water discharged by enterprises meets the receiving water quality standards of the municipal drainage system, the waste water can be discharged and the same will be treated in the city waste water treatment plant. If it exceeds the standards, the water must be pretreated before discharge. In this way, we could save money, labor and land, and increase efficiency as well. This method is already practiced in Tianjing and some other cities. In the Jizhuangzhi waste water treatment area, Tianjing set up a large waste water treatment plant which is the largest and the best equipped plant in China at present. The treatment capacity of the plant is 0.26 million tons per day. The operation of this facility shows that large-scale treatment is much more economical than individual treatment. It is estimated that such facilities can save 17 percent in construction investment and 66 percent in operation charges.

In order to strengthen the laws governing quality management, each province has published a series of local regula-

tions. The Beijing people's congress passed the "Regulation on Enforcing the Water Pollution Control Law of P.R.C. in Beijing"; the Shanghai people's congress issued the "Regulation on Protecting Upper Reach Water Sources of Huangpu Jiang." These local regulations contain strong directives. They are relatively specific and are clear about their protection objectives. For instance, Beijing worked out a policy of "degradation of clean waters is not allowed; water bodies in suburban areas should quickly be improved; and drinking water sources should be specifically protected" to be directed against the situation of insufficient water sources and endangered drinking water sources.

WATER POLLUTION CONTROL MEASURES

The key elements in controlling water pollution are management, technology and investment. At present, there is no problem in technology, while the investment must depend upon the country's financial capacity. The seventh and eighth five-year plans will not provide much money for pollution control. Old debts have not yet been paid and new debts are coming. At present the quantity of waste water is increasing by ten percent. If we want to keep it to three percent in the future, the key point is management.

(1) We must put emphasis on controlling new pollution sources and reducing discharges from existing sources. Newly built enterprises should evaluate environmental impacts and carry out "three at the same time" actions. This system is practiced about 80 percent of the time in large and medium sized construction projects. However, most village and neighborhood entities do not follow the "three at the same time" system. In addition, pollution caused by developing production, non-point pollution sources and harbor pollution should also be controlled. To harness existing pollution, the major need is money. Although every year one billion RMB obtained from discharge fees is used for pollution control, the amount is still far from enough. So the state planning for economic construction should include a certain percentage of funds for pollution control.

(2) The management should be carried out in accordance with the law and on the basis of science. On the legal side, China has passed the "Water Pollution Control Law", but it still needs to establish other regulations to enforce the law. In order to protect water sources, we use the system of discharge licenses. Through controlling the total amount of pollutant discharge, the goal of protecting water sources could be achieved.

(3) In order to strengthen its environmental monitoring work, China has established more than 840 monitoring sta-

tions, and each water system has set up its own station as well. These stations form a water quality monitoring network serving as a foundation for monitoring management. Recently, China has amended the surface water quality standards and the waste water discharge standards. These standards provide a basis for enforcing the law.

(4) One of our very important pollution control principles is "save water; reduce discharges; use comprehensively and turn bane into boon." Reusing water for different purposes, recycling water, and using treated waste water are valuable measures to make up for insufficient water sources and to prevent water pollution. In the future, when establishing new factories, advanced technology and equipment should be taken into consideration so as to avoid discharges or to discharge less waste water. The reuse of waste water, either treated or untreated, should be considered. The operation of existing equipment should be improved to avoid waste water run off. At the same time, technical reforms should be adopted and control of waste water should be carried out. "To save water and reduce discharges" should be established as a state policy to be implemented mandatorily. Each managing department should set a quota of water consumption per unit product so as to promote the reuse rate of water. Saved water could then be a standard to be used in examining an enterprise's performance.

(5) We should plan and develop rationally. In China, most of the seriously polluted water bodies are in big and medium cities or neighboring areas. Among 798 cities, there are 15 in which the daily effluent quantity exceeds one million tons. These 15 cities represent only 1.9 percent of the total number, while their total effluent quantity equals 39 percent of total national discharges (about 35 million tons per day). In addition, the daily discharges from 18 cities are 0.5 to 1 million tons, and 85 cities discharge from 0.1 to 0.5 million tons. These 118 cities represent only 15 percent of the total, but their discharge equals 80 percent of the total discharge quantity. It is clear that the major source of water pollution is in big and medium cities. The industrial lay-out of these cities is poorly planned. In future economic construction, pollution sources which cause serious nuisance to the public, pollute water sources, or affect scenic spots should be modified in the planning process. Water bodies should be designated for different protection levels according to their functions.

(6) We should make overall plans and control comprehensively. Water pollution control in a city or area must have an overall plan. Such plans should be worked out with consideration of local conditions and for developing trends. To control waste water it is necessary to bring all

industrial waste water into treatment and to complete city drainage systems and waste water treatment facilities. China does not have many urban industrial waste water treatment facilities. Most cities are facing the task of reforming the existing city lay-out and adjusting the industry structure. This makes waste water control more complex. So the work of urban waste water control must be combined into the general development plan of the city and be carried out at the same time as industrial development.