

Theme Paper

# URBAN ENVIRONMENTAL MANAGEMENT

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This paper analyzes the management aspects of urban water supply, wastewater, and solid waste. It also suggests improvements in regulations, policies, institutions, administration, public participation, and market mechanisms that will restore the urban environment.

## URBAN ENVIRONMENTAL MANAGEMENT

### Environmental Service Level

The People's Republic of China (PRC) is a huge developing agricultural country that has been rapidly urbanizing since 1978, when it opened its gates to the outside world and undertook economic reform. Then, the country had only 193 cities, an urbanization rate of 17.9 percent, and an urbanization level of 8.3 percent. By 1997, it had 668 cities, an urbanization rate of 30 percent, and an urbanization level of 15 percent. The urban population grew by 115 percent from 170 million to 370 million. The nonagricultural population increased by 131 percent, from 80 million to 185 million.

Urban infrastructure developed swiftly, and service facilities and the urban environment improved immensely. By 1997, 2,061 public or nonmunicipal water plants were operating, with a total

capacity of 206 million m<sup>3</sup>/day and laid pipeline of 215,600 km, producing 47.68 billion m<sup>3</sup> of water annually. Water consumption per capita reached 213 l/day, and the public water supply service rate was 95.16 percent among the urban nonagricultural population. Meanwhile, 309 wastewater treatment plants were built with a capacity of 12.92 million m<sup>3</sup>/day. Their 119,700 m of sewer pipeline had an annual discharge rate of 35.1 billion m<sup>3</sup>. Solid waste management has also made great progress. Before 1990, the solid waste treatment rate was less than 2 percent; by 1997, 110 million tons of solid waste and 30 million tons of night soil were collected annually from cities. More than 600 waste treatment plants with an annual treatment capability of 130 million tons, and 100,000 public toilets were built.

Rapidly growing cities consume great quantities of natural resources and energy, causing extensive urban deterioration that not only harms residents' health but also hinders sustainable development. The Government's drive in 1992 to build clean, green cities improved some urban centers, but did not check pollution at its source.

#### Environmental Laws

The PRC has two environmental legal systems—the vertical system and the lateral system. In the vertical legal system, laws may be divided into two tiers—State law and local law. State laws are governed, in order of importance, by (i) the Constitution, (ii) the Environmental Protection Law, (iii) relevant articles in other laws, (iv) international treaties signed by the Government, (v) administrative regulations issued by the State Council, and (vi) codes and rules on environmental protection. State laws govern local environmental laws, delineating their scope and content. Local environmental laws are geared toward conditions in specific areas.

Seven categories of laws make up the lateral legal system:

- comprehensive laws for environmental protection such as the Environment Protection Law and the City Planning Law;

- laws to prevent water and air pollution and public hazards and to manage solid waste;
- laws to protect nature, including national parks, tourist spots, plant and animal habitats, and historic and cultural relics;
- laws to protect natural resources, mainly water, and to regulate their rational development and use;
- laws on special environmental management, including environmental monitoring, urban water supply quality control and tariffs, urban wastewater discharge and monitoring, construction projects, licensing of urban water suppliers, among others;
- laws on environmental standards for drinking water, wastewater discharge, urban wastewater quality analysis, among others; and
- laws on environmental liability, which determine pollution and environmental damage, liability for such damage, and procedures for penalizing offenders.

#### Environmental Management Regulations

The Environmental Protection Law defines the management scope, content, standards, liability, and some environmental management systems. Methods to manage wastewater concern (i) treatment; (ii) discharge and treatment monitoring, tariff systems, and tariff collection; (iii) environmental impact assessment; (iv) discharge permits; and (v) river valley pollution prevention.

Means of managing and protecting water supply include (i) permits for water use and water supply enterprises; (ii) water resources fees; (iii) water supply quality control, analysis, monitoring, and quality analysis systems; and (iv) users' fees.

The basic principles of solid waste management are (i) "reduce, reuse, and treat"; (ii) "control the process"; and (iii) "separate waste." Transporting solid waste across borders is regulated. The waste management license system includes listing, identification, and disposal of hazardous waste.

### Environmental Agencies

A consolidated environmental management system operates according to the ministries' scope of duties as determined by the State Council. The State Environmental Protection Agency (SEPA) supervises environmental protection nationwide. Other agencies perform their respective duties. The Ministry of Construction (MOC), for example, manages urban water supply, water conservation, drainage, and wastewater treatment under the supervision of SEPA, the Ministry of Water Resources (MOWR), and the Ministry of Health (MOH). Municipal construction agencies are in charge of wastewater engineering construction (including technical evaluation and budget preparation), operation, and administration. They are also responsible for monitoring the quality of wastewater discharged into the sewer system.

The Urban Water Supply Regulations, promulgated by the State Council in 1994, put the State Council's urban construction agencies in charge of the entire country's water supply. Under the State Council's agencies, construction and water supply agencies of provinces, autonomous regions, and cities above the township level are responsible for water supply works in their jurisdiction. The Urban Water Conservation Regulations also put the State Council's urban construction agencies in charge of the entire country's water conservation, under the direction of the State Council's water agencies. The provincial, autonomous region, and township construction agencies are responsible for water conservation works in their jurisdiction.

Solid Waste Pollution Prevention Regulations, issued in 1995, put the urban construction agencies of the State Council and the environmental sanitation agencies of the municipal governments above the township level in charge of monitoring and managing municipal solid waste collection, transportation, storage, and disposal.

As determined by the State Council, the management system is divided into the national and local. MOC's Urban Construction Department leads urban environmental management at the national

level. Three divisions under the department—public utilities, municipal management, and environmental sanitation management—are responsible for monitoring and managing water supply, water conservation, wastewater engineering, and solid waste. SEPA is responsible for enforcing environmental standards. MOWR is responsible for allocating and distributing water nationwide. MOH is responsible for supervising environmental sanitation.

Local agencies are divided into the provincial and the municipal. At the provincial level, the duties of departments concerned with construction, environmental protection, water resources, and health are similar to those of their national-level counterparts. The organization structures of autonomous regions are similar to those of the provinces. Municipalities such as Beijing have bureaus concerned with public utilities, municipal engineering, and environmental protection, all under the municipal Engineering Administrative Committee. Medium-sized and small cities have agencies with corresponding departments or divisions, and with similar responsibilities.

In 1999, MOC issued Quality Control for Urban Water Supply and improved the monitoring system. The system—“two-tier networks and three-tier stations”—aims to raise water quality monitoring and management. The “two tiers” refer to national and local networks. The national network—also called the national station—includes MOC’s Quality Control Center for Urban Water Supply and the stations in big cities such as Beijing, Shanghai, and the provincial capitals. The local network—or local center station—includes stations in provincial cities. The “three tiers”—national headquarters, national stations, and local stations—are in charge of monitoring and supervising water quality control according to the Standards of Quality Management for Urban Water Supply. Since May 1999, the national stations have been required to report on the quality of local pipe systems and treated water to national headquarters. MOC publicizes the reports as well as the urban air quality index in order to make people aware of their responsibility to control pollution and conserve water. MOC is organizing establishments specializing in urban drainage, monitoring, and wastewater management.

## ANALYSIS OF KEY PROBLEMS

### Urban Water Supply

Urban water supply is made up of municipal water supply (60 percent) and water supply provided by individual entities (40 percent). Surface water accounts for 70 percent and groundwater for 30 percent of total supply. In the last 12 years, however, water production capacity increased by 6.4 percent and water supply by 5.1 percent annually. However, water supply remains insufficient and water quality has not improved. Major problems are the following:

- *Lack of water supply facilities.* A 1995 MOC report investigating 548 out of a total of 570 cities indicated that as of 1993, 333 cities suffered water shortage. For 260 (78 percent), the reason was insufficient water supply facilities. Of the 32 major cities, 31 suffer a serious lack of facilities. The ratio of water supply capacity to peak demand was less than 1 in 1973-1994. Although additional investment has raised the ratio to 1.16, it still lags far behind the minimum acceptable value of 1.3-1.5. Of the 370 million urban residents surveyed, 145 million (including 10 million in non-agricultural areas) still do not have access to water supply service.
- *Pollution of water supply.* Of the 333 water-short cities, 19 lack water because their water supply sources are polluted, and another 76 because of pollution-related factors. Many cities have to transport raw water over long distances. Direct discharge of untreated wastewater is the main cause of pollution of water supply sources. Environmental agency monitoring reports show that more than 90 percent of municipal water supply sources are heavily polluted. Water supply sources of half the key cities and towns do not meet environmental and health standards. Of these urban centers, 98 suffer severely polluted water supply sources. Pollution has widened the gap between supply and demand. At

least half of all urban residents who rely on the facilities they built themselves do not have access to potable water supply.

- *Shortage of water supply sources in some cities.* Water shortage is due to unequal distribution of water resources. Of the 333 water-short cities, 49 (15 percent) simply lack water resources. A study of 18 cities served by the Water Diversion from the Yangtze River to North China Project (covering Beijing, Tianjing, Hebei, and Henan) shows that Dingzhou and Zhuozhou cities in Hebei province are short of water.
- *Water wastage.* Although progress has been made in urban water conservation, water wastage still occurs, and leaks in the domestic water supply are common. About 40 million toilet tanks leak, 25 percent of them leaking a total of 400 million m<sup>3</sup> of water annually. Water wastage in institutions, schools, hotels, and hospitals is even worse. Industrial water-use efficiency is much lower than in developed countries. Water consumption per Y10,000 output is 198 m<sup>3</sup>, or 4-6 times that in developed countries, and 10-20 times that in the US and Japan. The rate of industrial water reuse is 60 percent, equivalent to that of the advanced countries in the 1970s, and much lower than their current rate of 90 percent.

#### Urban Wastewater

The key problems in wastewater management are (i) the incomplete sewer system, (ii) insufficient treatment facilities, and (iii) low effective treatment rate. By 1997, 119,700 km of sewer pipeline were laid in 668 cities. Most sewer systems are of poor quality and drain both wastewater and storm water. About 40 percent of all cities do not even have a sewer network. Wastewater simply flows directly into rivers or lakes, or seeps into the ground, polluting the groundwater.

In 1997, 35.14 billion m<sup>3</sup> of wastewater (half industrial, half domestic) were discharged to surface water. Although 80 percent of industrial wastewater was treated before discharge, most of it

barely met discharge standards; 60 percent was mixed with domestic wastewater and discharged into the sewer system, which is 85,000 km long, with a transfer capacity of 21 billion m<sup>3</sup> annually.

Now, there are 160 wastewater treatment plants with an annual capacity of 2.89 billion m<sup>3</sup>, or a treatment rate of 8.2 percent. Of these, 119 treatment plants are equipped with secondary treatment facilities and have a total capacity of 688.65 m<sup>3</sup>/day. The secondary treatment rate is 7.2 percent. Less than 5 percent of all treatment plants can meet the discharge standard.

The central Government required cities with a population of at least 500,000 and having no wastewater treatment plants to build treatment plants before 2000. However, by end-1996, only 44 of 78 such cities had treatment plants. In the “three rivers and three lakes” catchment area, only 38 of 167 cities have treatment plants; 97 percent of townships have no treatment plants and have incomplete sewer systems.

The central and local governments have recently invested more in the construction of treatment plants. Many projects are underway and being planned. The World Bank, the Asian Development Bank, and some foreign countries have provided loans for some projects. In 1998, 237 project proposals for wastewater treatment were submitted, requiring Y60 billion. The central Government has tried to stimulate domestic consumption and to finance 157 projects, but with only partial success.

While a shortage of funds is certainly an obstacle to urban wastewater treatment, there are other important problems relating to (i) management, (ii) investment, (iii) cost, and (iv) tariff policy. Tight Government control and the Government’s investment system discourage efficient operation and market capital absorption. Low tariffs encourage unreasonable demand on water supply and wastewater treatment, which could lead to the inability to repay loans.

#### Urban Solid Waste

In 1998 alone, cities produced 120 million tons of solid waste. For many years, solid waste was disposed of without treatment,

polluting the water, air, and soil, and spreading infectious diseases. Municipal solid waste management in the PRC started only recently. In 1985, there were only 23 waste treatment plants, with an annual capacity of less than 700,000 tons. By 1990, there were 66 treatment plants, with an annual capacity of 2 million tons. The effective treatment rate, however, was less than 2 percent. After 1991, waste management made great strides. By 1997, there were 635 waste treatment plants, with an annual capacity of 62.91 million tons. The treatment rate was theoretically 57 percent, but after considering statistical error and the fact that less than Y2 billion were invested in 1991-1997, the actual treatment rate was less than 10 percent. Most solid waste was merely stored or placed in landfills—a method that does not meet the requirements of sanitary disposal—and often near cities. Even if it may contain useful material, solid waste is still not separated, reused, or recycled.

These problems are caused in part by the lack of a proper tariff policy and a market-based investment system. Insufficient funding and escalating costs for collecting, transporting, and treating solid waste give rise to a dilemma: it is affordable to build treatment plants but unaffordable to operate them.

## **ENVIRONMENTAL MANAGEMENT STRATEGY**

### Future Environmental Stress

Using 1997 figures, it is projected that the urbanization rate will be 32 percent in 2000 (400 million urban dwellers), 40 percent in 2010 (560 million), and 50 percent in 2030 (750 million). Demand for water will rise to 94 billion, 143 billion, and 218 billion m<sup>3</sup>, respectively, which will require an increase in water supply capacity by 145 billion by 2030 as well as a commensurate increase in investment of Y725 billion. Overall, Y20 billion a year will be required to keep up with demand. Meanwhile, more wastewater will be produced. Rough estimates from different sources show that before 2010, investment in wastewater management will be in the range of Y100 billion to Y200 billion. Faced with such enormous

problems regarding funding, resource requirements, and the environment, Governments should develop strategies for urban sustainable development.

#### *Institutional and Legal Frameworks*

The decisive factors in achieving efficient urban environmental management are (i) effective institutions, (ii) a first-rate legal system, and (iii) strong policy support. Urban environmental management is closely related with urban planning, construction, and maintenance. Local governments should therefore have sufficient autonomy. Mayors should be the top managers. Urban construction agencies should take full responsibility for urban environmental planning, sanitation construction, and protection. Urban environmental protection agencies should be responsible for general monitoring and supervision.

MOC should carry out policy guidance, macro planning, market orientation, and sector supervision. The central Government should not interfere with city governments' responsibilities. SEPA should set up and implement environmental protection policies and standards. Local agencies should be guided by the principle of separation of government and enterprise—i.e., government and enterprise should not encroach on each other's jurisdictions. Enterprises in the public, municipal, and sanitation sectors should behave like modern businesses. The National Institute of Urban Water Supply Quality Control, the National Monitoring Network of Wastewater Discharge Quality, and other related agencies must be allowed the freedom to fully assist Government.

The Regulations on Urban Wastewater Discharge must be prepared as soon as possible to establish a wastewater treatment billing system and centralized wastewater treatment. The Law on Urban Planning should be amended to include integrated environmental planning and management in order to allow urban planning and construction to proceed without harming the environment.

### Water Resources Management

The core of water resources management is water allocation and quality control. Some strategies to develop water resources, the water environment, and the social economy are suggested below:

- Guaranteeing water conservation through legislation and policy and in practice. It is necessary to produce water conservation tools, and to encourage water conservation by setting up water conservation models.
- Using wastewater treatment to develop urban water resources without harming the environment. Wastewater treatment will improve the urban environment, protect water resources, increase available water, and reduce the need for investment in water supply. Some cities neglect wastewater treatment, paying attention only to providing water, which results in waste, pollution, and destruction of water resources.
- Ensuring the reasonable exploitation, optimal allocation, and highly efficient use of surface water, groundwater, rainwater, seawater, and recycled water.

### Public Participation

It is important that urban residents participate in environmental protection for the sake of their own health and quality of life. The public has the right to know the state of the environment. Cities such as Beijing announce the air quality index, earning the approval of their residents. Since May 1999, MOC has publicized water supply quality in 36 major cities, also gaining support from urban communities. These moves signal the beginning of public participation.

Governments should continue to develop ways of informing the public about water pollution, water quality, and pollution by wastewater. They should let the public know how governments try to improve the environment and what the public's responsibilities and obligations are. The better the understanding between govern-

ments and the public, the better policies will be implemented and the environment protected.

The public should also have the right to evaluate the environment. Allowing the people to express their opinion and give suggestions will help agencies collect ideas that will improve policymaking and planning. It will also let the people know how to participate in protecting the environment. The public has the right to be involved in managing the urban environment.

Since guidelines have been issued on urban water pricing, some cities have been holding regular public hearings in order to narrow the gap between governments and the people. The method has proven to be a good one in some advanced countries. For example, it is effective in showing the people that not only do they have the right to participate in decision making, but that they also have the duty to pay their water and sewage treatment bills on time.

#### Marketing Mechanism

The primary task is to turn agencies handling municipal water supply, wastewater treatment, and solid waste management into market-oriented enterprises. Governments can ease their financial burden by (i) establishing market-based investment and (ii) regulating the water-users' fee, sewage charge, and service fee in order to obtain market-based funds. Efficiency and good service will then become profitable.

Another important aspect of introducing market mechanisms into urban environmental management is the regulation of environmental protection through market competition. Giving some enterprises a special authority to invest, construct, and operate urban infrastructure within a certain period would mitigate the lack of funds and also reduce the risk of putting all the governments' eggs in one basket.

### **URBAN ENVIRONMENTAL PROSPECTS**

Although urbanization has developed rapidly in the last 20 years, the PRC is still 30 years behind the advanced countries. In the 21st century, however, the PRC will develop faster. By 2030, half the population may be living in cities. Urban environmental stress will therefore increase. Ongoing reforms—transforming governments' responsibility and promoting market-oriented enterprises and financing and investment systems, for example—will nourish the socialist market economy. In the next 30 years, with the improvement of the legal system and the market mechanism, more investment will pour into urban environmental protection.

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