A CHINA ENVIRONMENTAL HEALTH PROJECT RESEARCH BRIEF

Environmental and Health Challenges of Municipal Solid Waste in China

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Chinese municipalities currently generate about 190 million tons of trash per year and, by 2030, this could increase to 480 million tons, nearly double the amount the United States is projected to produce over the same period(1). With over 5,000 "brownfield sites" from poorly managed landfills and the likely need for 1,400 additional landfills over the next 25 years, the issue of municipal solid waste represents a major land-use challenge in China, a country with only 7 percent of the world's arable land and the largest population. Contamination of water and soil from poorly managed municipal landfills also poses growing health and ecological threats in China. The Chinese government has been advocating the creation of a "circular economy" in China to increase efficiency of resource utilization by a factor of 10 by the year 2020 to diminish the growing waste problem.

Trash Trends

Every year Chinese cities generate one-third of the total garbage produced in the world (2). Worldwide, the amount of trash produced is growing at a rate of 8 percent annually and in China this figure is over 10 percent. The China Council for International Cooperation on Environment and Development (CCICED)—a high-level nongovernmental advisory body that works to strengthen environmental cooperation and exchange between China and the international community—recently released the report The Status and Trend of Solid Waste in China, (3), which highlighted some sobering municipal waste trends in China:

• An average urban resident in China generates 440 kilograms of waste a year—much less than their U.S. counterparts at approximately 766 kilograms per year—but per capita waste rates in Chinese cities are rising quickly.

• Beijing, Shanghai, and Shenyang are the three largest waste producers, yet recycling rates remain quite low in these cities.

• Among China's 660 cities, 52 of the big and medium cities (with a population of over 500,000) produce 60 percent of the country's total garbage. Few of these cities have adopted comprehensive municipal waste reduction and recycling programs.

The CCICED report also summarized some of the land-use problems associated with municipal solid waste in China:

- Landfills of solid waste have already rendered 50,000 hectares of land around cities useless.
- In another 13 years, the landfills in China's urban areas will reach capacity.
- Garbage pile-up in 2020 would reach 400 million tons, equivalent to the volume generated

by the entire world in 1997.

Health Impacts

When poorly managed, solid waste can cause considerable threats to the environment and human health as it decomposes, during incineration, and through the leaching of toxins. The incineration of waste emits chemicals detrimental to human health, most notably dioxins, furans, and mercury. As of 2005, the Ministry of Construction aimed to increase the rate of waste incineration from 29 to 30 percent of total waste, a change that could double the global ambient levels of dioxin and significantly increase levels of furans and mercury (4); this poses a threat to human health in China and abroad. An additional concern is the large accumulation of methane during waste decomposition. According to the CCICED report, methane explosions in waste piles and landfills were reported over the past few years in more than 20 cities.

Most of China's older landfills do not have proper linings and, as a result, leach toxins into nearby soil, ground, and surface water. In addition, the current practice in China of creating landfills with flat tops generates ten times more leachate than landfills with sloped tops(5).

Not all municipal waste, particularly industrial, even makes it into landfills in China. Illegal dumping of municipal and industrial wastes have also been contaminating groundwater, rivers, and soil, threatening human and ecological health.

Growing poverty among rural migrants in Chinese urban areas and the lack of city-wide recycling programs has led to the growth of an informal sector of waste pickers, numbering approximately 2,500,000 people. These people are most directly affected by health threats from waste as they pick through urban waste collection sites and landfills for materials that they can sell. These individuals, who usually lack any form of health coverage, are vulnerable to traffic accidents, puncture wounds, chemical burns, back injuries, and respiratory illness from particulates (6).

Laws to Address the Municipal Waste Challenge

Creating the Foundation for Better Waste Management—The Solid Waste Law and Regulations China passed its first comprehensive law on solid waste in 1995 (Law on the Prevention and Control of Environmental Pollution from Solid Waste), which authorized the government to impose solid waste discharge fees on those responsible for waste discharges that do not comply with relevant environmental laws governing the land filling of hazardous wastes. While such fees initially were rather low, as some municipal governments have begun privatizing waste treatment and contracting to domestic and industrial firms. Such fees have increased, but not yet enough to cover all costs. The law also requires that operators of treatment/disposal facilities apply for operating licenses. The solid waste law laid the framework for setting a broad array of standards for solid waste storage and disposal, pollution control for landfills for hazardous wastes, discharge standards for livestock, and medical waste incineration and transport. In 2004, the import of hazardous wastes was banned, allowing only the import of solid wastes that can be used as raw materials or recycled safely.

Pushing Industries to Reduce Waste—The Cleaner Production Law

Industrial-commercial-institutional (ICI) generators make up over 50 percent of the waste

stream in China, which underscores the importance of the Cleaner Production Law (CPL) —passed in 2002 and put into force in 2003—that focuses on giving incentives to industries to reduce, recycle, and reuse wastes. Under the law, industries that adopt cleaner production processes and increase recycling of wastes can receive financial support from the State Council's Special Technological Development Fund and from the Small- and Medium-Sized Enterprise Development Fund. The CPL allows for products produced from wastes and materials reclaimed from wastes to have reduced or be exempt from value-added tax, and expenses incurred for cleaner production auditing and training may be booked as enterprise operating costs. In addition, the regulation promises commendations and rewards for conspicuous achievements in cleaner production.

The CPL has catalyzed numerous studies, projects, and programs often funded in part by international donors. Overall, the law (which has purely voluntary requirements) has not yet sparked significant changes in industrial practices nationwide, in great part due to local government protectionism. However, the law may become stronger since the central government re-emphasized the need to reduce industrial waste through China's 11th Five-Year Plan (2006-2010), which includes the goal of reusing 60 percent of industrial solid waste (7).

Creating a Circular Economy—From Concept to Policy

The Chinese government is increasingly viewing the concept of a circular economy (CE), also known as a life cycle economy, as a means of balancing rapid economic development in China. Based on the idea of material recycling and partially inspired by Japanese and German recycling economy laws, CE initiatives have been undertaken in Liaoning, Jilin, Jiangsu, Heilongjiang, and Fujian provinces, as well as in the cities of Shanghai, Guiyang, and Panzhihua.

Initial circular economy pilot projects in the 1990s were conducted under the auspices of the State Environmental Protection Administration (SEPA), however, in recent years, the concept has become a higher priority of the Chinese leadership, as evidenced in the shift in primary responsibility for its implementation from SEPA to the National Development Reform Commission in 2004. The goal of a circular economy was subsequently integrated into the 11th Five-Year Plan and discussed at the 16th National Congress of the Communist Party of China. The Environmental and Resources Committee of the Standing Committee of the National People's Congress began drafting a law to promote CE in 2005 and plans to submit it to the legislature for deliberation in 2007. The World Bank and the Italian government supported the drafting of the law and these two funders were also involved in the 2004 Italian Trust Fund for Environmental Protection in China, which included specific plans focusing on CE.

In 2001, SEPA and the Liaoning provincial government began the first provincial-level demonstration of a circular economy program, focusing on the development of ecoindustrial parks and eco-industrial networks. Between 2001 and 2003, more than 230 key enterprises in Liaoning completed the evaluation of clean production and 3,933 clean production projects were implemented. The reuse or extraction of waste—including household electrical waste, fly ash, and toxic coal tailings—was dramatically increased in the province, as well as the reuse of more than 1.2 million tons of wastewater per day (8).

Turning Municipal Waste Methane into Energy

The biodegradation of organic matter creates landfill gas, which is about fifty percent methane. The prevalence of landfills has meant that China currently produces more methane than any other developing country. Methane is a greenhouse gas, but can be used as fuel for industry and vehicles.

Several landfill gas capture projects have been implemented in China, some in conjunction with the United Nations Development Programme (UNDP) and the U.S. Environmental Protection Agency (EPA). UNDP and the Global Environment Facility recently financed a \$5.4 million project in China to reduce landfill methane emission and improve management of municipal solid wastes. The project included three technology demonstrations on how to use landfill gas for electric power generation, incineration of medical wastes, and vehicle fuels. In addition, the project led to the development of a national action plan for the recovery and utilization of landfill methane and the establishment of a national training center to disseminate waste-to-energy technologies. In 2003, the Landfill Methane Outreach Program (9) of the EPA held its third Methane Mitigation Conference and, in fall 2007, a Methane to Markets Partnership Expo will be held in conjunction with the Third Methane to Markets Partnership Meeting in Beijing.

Besides helping energy-starved cities in China, according to a World Bank report, carbon credits from turning methane into energy could generate as much as \$1 billion per year for Chinese cities.

Needed Investment and Infrastructure

The 2005 World Bank report, Waste Management in China: Issues and Recommendations (3) noted that for China to adequately address its growing solid waste the country must:

- Increase the national waste management budget eightfold over the next 15 years.
- Develop approximately 1,400 more landfills over the next 25 years.
- Emphasize composting, as approximately 50 percent of the waste stream is organic.

The report also focused on the introduction of "tipping fees" based on waste amounts in order to pay for the necessary increase in the waste management budget. This fee currently only covers 30 to 40 percent of total solid waste management costs, but is targeted to increase in order to cover 90 to 95 percent of such costs by 2020.

Case Study: Beijing

The Beijing municipal government set up the city's first garbage sorting and recycling center in Xicheng district in 1996. This center was followed by the establishment of another recycling center for waste batteries in 1998 and a mandate in 2000 for all municipal party and government organizations to recycle waste paper (10). In 2005, the first residential plastic and paper collection and recycling center was set up in Xuanwu District (11). By 2005, Beijing had built 3,090 waste collection and recycling stations (1,896 fixed recycling stations and 1,194 floating stations) (12).

According to the Beijing Circular Economy Development Plan (2006-10) and the Beijing Solid Waste Disposal Plan (2006-10), Beijing aims to create a standard recycling and waste management system of approximately 2,000 (mostly mobile) community recovery stations

and sixteen large garbage disposal plants in order to become a 'model resource-saving city' by 2010 (13). As of 2005, 90 percent of Beijing's garbage was buried, taking up 327 hectares of land. The remaining garbage was burned (2 percent) or composted (8 percent). The Beijing municipal government has set the following goals for waste in 2010:

- Increasing waste paper recovery rates to 80 percent.
- Increasing plastic recovery rates to 60 percent.

• Setting up a home appliance disposal system with the capacity to dispose of 2.1 million appliances (about 70,000 tons) annually so that 80 percent of discarded home appliances and 95 percent of waste automobiles are recovered.

Case Study: Shanghai

Reflecting the municipal government's commitment to the circular economy policy, approximately 3 percent of Shanghai's GDP is currently spent on solid waste management, and this number continues to grow. Besides devoting more than most Chinese cities on improving waste management, the Shanghai government is unique in that it has turned over most waste treatment work to private companies. Such private companies can only thrive in Chinese cities if fee rates for collection increase. Shanghai has undertaken pilot programs in two communities in Minhang district, charging 2.5 Yuan per household each month and 30 Yuan per ton from institutions (14). Unlike most other areas of China, which have to use costly and environmentally degrading supplemental fuel in waste combustion, moisture levels around Shanghai make waste combustion barely autogenic (having a high enough heat value to burn on its own).

International Projects to Improve Waste Management Several recent World Bank projects have targeted waste management in China:

• Liuzhou Environment Management Project—This \$100 million loan is focused on improving the environmental conditions in Liuzhou through improved wastewater treatment, sanitation control, solid waste management, and industrial wastewater pollution control.

• Zhejiang Urban Environment Project—This \$133 million loan supports activities to enhance the efficiency and equity of waste management in Ningbo and Hangzhou municipalities and support measures to increase the utilization of waste treatment facilities, as well as improve waste management institutions and finances through implementation of utility reform measures.

• Shanghai Urban Environment Project—One key part of this \$200 million loan project is to help develop market-based approaches for solid waste services in Shanghai.

The Asian Development Bank also has some ongoing urban development projects that focus on improving solid waste management in a number of municipalities: Baiyin (Gansu), Nanning (Guangxi), Fuzhou (Fujian), Hefei (Anhui), and Changchun and Yanji (Jilin).

Future CEF Coverage of Municipal Waste Issues

The China Environment Forum will be adding other fact sheets and research briefs on this and other waste topics throughout 2007 and 2008. Moreover, the upcoming China Environment Series Issue 9 in the fall of 2007 will include more analysis on the waste and health issues in China.

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