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***Environmental Protection and Economic
Development: The Case of the Huaihe
River Basin Cleanup Plan***

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Comments Welcome

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**Environmental Protection and Economic Development: The case of the Huaihe River Basin
Cleanup Plan.**

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Abstract

The case examines efforts by the Chinese government and local authorities to restore the Huaihe River, a 1,000 kilometer waterway which runs through four provinces in eastern China. The river basin, covering an area of some 270,000 square kilometers, is home to almost 150 million people and represents one of the most important areas of agricultural output in China. As a result of rapid economic development, the river has, over the past twenty years, become seriously polluted. This has had dire consequences for industries that depend on the river, notably agriculture and fishing. As well, the limited groundwater supplies in eastern China have meant that surface water has always been an important source of supply for residential and industrial uses. The pollution of the Huaihe has therefore had serious public health consequences. In mid-1995, the Chinese government formally adopted an ambitious plan to restore the water quality in the river.

The case is based on material gathered from secondary sources, supplemented by interviews conducted with government officials and company managers in Beijing and Anhui province in China. The case begins with an overview of the impact of economic growth on the Chinese environment, and the steps which China has taken to address its growing environmental challenges. The case then focuses on the plan as proposed by the Chinese Research Academy of Environmental Sciences (CRAES). The case goes on to describe some of the early implementation measures taken as part of the plan, in particular the forced closure of hundreds of small factories that have sprung up along the banks of the river. The case outlines the various stakeholders affected by the plan and its ultimate success or failure. These include local residents and businesses, various Chinese government ministries, multilateral lending agencies and international suppliers of anti-pollution technologies. The ultimate success of the plan is, at the time of this writing, not known. Future issues and questions that will affect the plan's success are then described. These include resistance by some elements of the Chinese government concerned about foreign debts incurred to finance the cleanup plan; local officials who may not wish to sacrifice short-term economic growth for environmental protection; and businesses concerned about the financial burden of having to install new clean technologies.

Economic Development and Environmental Degradation

The focus of environmental attention has been shifting in recent years away from one that centers on developed countries to one that is focusing on developing countries. In fact, many environmentalists and economists feel that addressing environmental degradation in developing countries as well as Eastern Europe should be the primary focus of environmental policy in developed countries. A quick inventory of environmental problems associated with developing countries includes problems such as severe air pollution; tropical deforestation; desertification; contamination of already limited drinking water supplies; soil erosion threatening already shrinking agricultural land bases; habitat destruction and the resultant loss of biodiversity; and depletion of fish stocks in several key areas.

In the 1970s and early 1980s, many people felt that environmental quality was a luxury that only the rich nations could afford. However, in the 1980s, it began to become apparent that deteriorated environmental quality was interfering with the economic development of many countries and that economic development cannot take place without environmental improvement.

Most development projects initiated in the 1960s, 1970s, and early 1980s, were focused on capital formation. Large capital-intensive projects involving dams, factories, energy facilities, and large scale agriculture were initiated, but these projects were often not successful in improving the productivity of the economy. Meanwhile, some economists feel that a major reason for the continued--even worsening--standard of living is the continuing environmental degradation in many developing countries. This degradation has frequently been exacerbated by some of the large-scale capital intensive development projects funded by multilateral institutions such as the World Bank, Asian Development Bank, Latin American Development Bank, etc.

At first, North Americans tended to view environmental quality as an amenity or even as a luxury good. However, environmental quality is not only a consumption good, it is an input to the production process. As an input, the environment may be even more important in developing countries that are more dependent upon primary production activities, such as agriculture, forestry, and resource extraction.

Environmental quality can affect economic productivity in two major ways. First, environmental degradation can drastically affect human health, which can affect the productivity of labor and consume resources in dealing with the adverse health effects. For example, intestinal disorders from contaminated drinking water are the leading causes of death of young children in many developing countries. Second, environmental resources are a direct input into many production processes, and environmental degradation interferes with these production activities. A good example of this is deforestation, which leads to soil erosion, which inhibits agriculture and causes the siltation of rivers, which leads to diminished fishery output. The loss of forests also precludes future economic activity that would directly use forest resources, such as timber and wood product industries.

Much of the environmental degradation in developing countries is due to their low standards of living. Typically, low income makes it very difficult to meet current consumption needs, so environmental resources are unwisely exploited to produce current income. Agricultural areas are cultivated too intensely in order to produce food for the short run, which leads to soil erosion and a decrease in soil fertility that diminish the long-term ability to produce food. Current needs for food lead to large livestock herds which over-graze range land, diminishing the productivity of the very same range land so that it can support fewer animals in the future. Both deforestation and over-grazing are significant factors in the process of desertification, where deserts expand into areas that were formerly vegetated.

This process of degradation is not simply limited to agricultural processes. In many countries, such as the People's Republic of China, high levels of pollution are produced as a result of industrial activity. Meanwhile, the government does not implement environmental policies or devote resources to pollution control, since these resources are needed to meet current consumption needs. Unfortunately, high levels of air and water pollution degrade public health, reduce the productivity of agriculture, industry, fisheries, and forestry, and generate other social costs that reduce the country's future ability to produce income.

Population growth is portrayed in the popular media as the root of all evil, in the sense that population growth is suggested as the primary cause of both environmental degradation and the poverty that exists in many developing countries. This conclusion is allegedly supported by the high degree of negative correlation between the growth of income and the growth of population and the high degree of positive correlation between environmental degradation and the growth of population. However, correlation does not imply causation. Rather than rapid population growth leading to slow or negative growth in income, might the low income be leading to the high population growth? Or might the causation actually run in both directions (population growth affects income, and income affects population growth)? Since income and population growth are correlated, might the observed relationship between population growth and environmental degradation actually represent a relationship between income and environmental degradation, which runs in either or both directions?

Population growth tends to exacerbate income inequality. There are several reasons for this. First, as population grows, the land available for the poorest elements of society remains constant, since population growth tends to be highest among poor agrarian families. As a result, population growth tends to shrink the average size of an agrarian family's plot. This not only reduces their productive capacity, but tends to lead to overly intense exploitation of the land. For example, with small land holdings, families do not have the luxury to leave parts of their land fallow so that it can renew its productivity. This leads to soil erosion and declining soil fertility, which obviously increases the poverty of these poorest families.

Economic Growth and Environmental Degradation in China

China's economy has been one of the world's fastest growing over the past twenty years. Economic growth has averaged 10 percent annually between the onset of economic reform in 1978 and 1996, but this figure seem to understate the boom that is underway, especially in Southeast China.¹ Goods are abundant, and life of the average person is clearly better than it was two decades ago. By some measures, China now has one of the largest economies in the world. The typical standard of living, however, is still limited compared with that in many industrialized countries. Moreover, the pace of growth may not be maintained. Since 1993, some serious cracks have been developing in China's economy, notably periodic bouts of inflation, huge

losses incurred by thousands of state-owned enterprises, and a massive portfolio of non-performing loans held by the state-owned banking sector.² Meanwhile, poverty remains a severe problem, especially in the remote interior regions of the country.

Even under the best of conditions, China would represent a major environmental challenge. The country's 1.2 billion people, over one-fifth of mankind, are mostly packed along the eastern and southern coasts in an area about the size of the United States east of the Mississippi. Despite a stringent one-child policy, the country continues to add about 12 million people a year. If the government's population control efforts do not reduce the fertility rate, China will have over 2 billion people by the middle of the next century³.

The combination of these two factors – booming economic growth and a huge population – is threatening China's environment and its natural resources. Water supplies in several sections of the country are dwindling, while most of China's rivers, especially near urban areas, are seriously polluted. Despite having almost 22 percent of total world population, China possesses only 8 percent of total fresh water supplies. China's Minister of Water Resources has estimated that the country already has a shortage of 30 billion cubic meters (1 trillion cubic feet) in the rural areas, where almost four-fifths of the population lives, and six billion cubic meters (over 200 billion cubic feet) in urban areas.⁴ Out of 600 large and medium-sized cities, over half are short of water, and 108 are already seriously in need of water.⁵ In Beijing, for example, the average per capita water availability is less than 400 cubic meters, one-twenty-eighth the world average, and in some cities in the north of the country water supplies are even lower.⁶ Several studies by the Chinese government are predicting even more severe water shortages over the next two to three decades if effective measures to protect and increase China's water supply are not taken.

Compounding the problem of inadequate fresh water supplies, China is hit by frequent droughts, which affect over 20 million hectares of farmland every year, and have been responsible for a reduction in grain output of more than 3.5 tons between 1990 and 1994.⁷ At the other extreme, a significant portion of China's farmlands have been subject to disastrous floods. Chinese officials estimate that the amount of land classified as "easily flooded and drought damaged" has doubled since the early 1980's, to almost 40 million hectares.⁸ China's

food production capability is under further assault from severe erosion, which not only reduces soil fertility but results in damage to irrigation systems. This, in turn, increases the probability that an area will experience drought damage.

As if the prospect of providing food and water to China's huge population was not daunting enough, the country's breakneck pace of economic growth over the past fifteen years has complicated things even more. Increased economic activity has had a disastrous impact on China's environment. Each day, hundreds of ever-expanding cities and tens of thousands of factories together dump more than 100 tons of sewage and effluent, eighty percent of which is untreated, into the country's lakes and rivers. Out of 532 rivers monitored by China's Ministry of Water Resources, 436 are polluted, and 13 of 15 sections of China's seven largest rivers near major cities are classified as "seriously polluted".⁹ Outbreaks of disease as a result of consuming contaminated water or seafood grown in contaminated water are common, the most dramatic being an outbreak of hepatitis A which struck over 300,000 Shanghai residents in 1989.

Air quality has also become a major problem. Over 75% of all China's power generation is derived from burning coal, and China is the largest producer and user of the mineral in the world. In 1990, China's commercial sector consumed the equivalent of more than 1 billion tons of coal, roughly 10 percent of global commercial energy consumption.¹⁰ The country's total energy consumption (commercial and non-commercial) in 1990 accounted for 11 percent of global carbon dioxide (CO₂) emissions.

Despite its resource endowment and the rapid expansion of its energy sector, persistent and severe shortages plague China. As a result, many of China's industrial enterprises are unable to operate at full capacity¹¹ while residential customers are subject to regular blackouts.¹²

Coal burning for industrial and domestic use results in heavy concentrations of sulfur dioxide and nitrogen oxide in the air over most Chinese cities. Chinese officials concede that fewer than five of the country's 500 largest cities have clean air.¹³ According to China's National Environmental Protection Agency (NEPA) 1996 review of environmental conditions in China, Chinese cities on average had 309 micrograms of suspended

particle emissions per cubic meter, with some areas registering as high as 618 micrograms. This compares with World Health Organization (WHO) standards of between 60 and 90 micrograms per cubic metre.¹⁴ NEPA's study found that daily average readings of sulfur dioxide were nearly double WHO standards, with some cities reporting readings ten times as high.¹⁵

Not surprisingly, respiratory disease rates in China are five times those that occur in the United States.¹⁶ NEPA's 1996 report states that respiratory diseases now are tied with cancer as the main cause of death for rural dwellers, and the fourth leading cause of death among urban dwellers.¹⁷ NEPA points out, however, that both respiratory disease and cancer rates are attributed at least partially to pollution.¹⁸

China's heavy reliance on coal burning has major international implications. China already ranks second in the world in emissions of carbon, which produces carbon dioxide, an important contributor to the so-called greenhouse effect. The country's emissions grew at an annual rate of almost 28% between 1990 and 1995.¹⁹ As well, sulfur dioxide emissions arising from Chinese coal consumption are important contributors to acid rain over neighboring countries. One Japanese study attributed almost one-third of all acid rain falling on western Japan to China.²⁰

The Chinese government has increased spending on environmental protection from 45 billion renminbi (RMB) (.67 percent of gross national product) in 1986-90 to about RMB 83 billion (.85 percent of projected GNP) in 1991-95. This amount may not be sufficient for, as the government itself estimates, spending needs to be at least 1.5 percent of GNP just to control current environmental degradation.²¹

Despite talk of balancing environmental protection and economic development, Chinese policy is heavily tilted toward the latter. As the Chinese put it, one should not "give up eating for fear of choking."²² However, efforts to tackle environmental problems have yielded some results, though scarce financial resources tend to make any solution only partial. Another constraint is the inefficient use of basic resources such as coal and water, which are heavily subsidized.

Much of China's environmental policy rests on the principle that the polluter pays (see below). Rapid economic growth should enable the government to build on this, as should further efforts to remove resource subsidies and to decentralize decision-making authority by placing it in the hands of individual enterprises. No doubt enterprises faced with budget constraints and forced to pay market prices for resources will find ways to avoid wasting them.

Environmental Regulation in China

The Chinese leadership began expressing concerns about environmental degradation as early as 1972, when it agreed to send a delegation to the U.N. Conference on the Human Environment held in Stockholm. By 1977, the Beijing Environmental Monitoring Center was formed to take measurements, and within seven years a network of over 1,100 monitoring stations had been set up. However, it was not until 1979 that China passed its first environmental legislation, the Environmental Protection Law (EPL). The EPL contained a variety of regulations on pollution, including rules on the siting of factories with noxious emissions in residential areas; measures to authorize the forced closure of polluting factories; provision for environmental impact assessments for new or upgraded factories; and mandates that new or expanded factories incorporate pollution prevention technologies in their design, and that they meet stipulated emission standards.

A key provision of the 1979 EPL was the introduction of a system for fining polluters. According to Article 18 of the 1979 EPL, "in cases where the discharge of pollutants exceeds the limit set by the state, a fee shall be charged according to the quantities and concentration of pollutants released".²³ Until 1981, the system was run on a trial basis, primarily in the southeast of China, and between 1982 and 1987 was extended to the entire country. Under regulations issued in 1982, a nationwide fee schedule was established, but provincial and local governments could charge higher rates with central government approval. For industrial wastewater effluents, the fees for any given pollutant are based on the multiple by which the facility in question exceeds the relevant standard for that pollutant. Air emissions are based on the same principle, but are determined by the extent to which both concentrations-based and mass-based standards are exceeded. The 1982 regulations established four types of penalties for polluting firms. Factories are given a three-year grace period to meet standards, following which fees increase by 5% for each year that they fail to do so. Fees are doubled for

any new (i.e. post-1979) facility which is not built according to standards, or any older facility caught not operating its pollution abatement equipment. An additional fine of 0.1% per day is imposed for any payment of fees that is more than 20 days late. Finally, there are established fines for any false reporting of mandated effluent/emission reports and/or for interfering with inspections by relevant authorities.

Another unique element of the Chinese “polluter pays” program is the provision for making fees which are collected available to enterprises who need financing for the purchase and installation of pollution abatement equipment and/or cleaner production technologies. Some 80% of the fees collected are deposited in a local area fund, and all enterprises who have made payments to the fund are eligible for subsidies or soft loans for pollution control initiatives. Local environmental regulating bodies can keep the remaining 20% of the fees, along with 100% of fines which they collect, to defray enforcement costs. Since the beginning of the “polluter pays” program, some 200,000 industrial polluters have paid fees totaling 13.1 billion yuan (approximately U.S. \$1.6 billion at current rates).²⁴ Some eight billion yuan worth of investment in pollution control equipment and technology, or 16% of the total spent in China over this period, has been paid for by these redistributed fees.²⁵ Meanwhile, some 3 billion yuan of collected fees has gone toward upgrading various levels of government’s monitoring and enforcement capabilities, through increased training, while an additional 1.84 billion has been used to purchase monitoring and measuring equipment for regulators and to run various public education campaigns.²⁶

However impressive on paper, and despite some documented accomplishments, China’s “polluter pays” program has proven to be inadequate to address the country’s environmental problems. Firstly, fees have generally proven to be too low to deter firms intent on increasing production and satisfying the burgeoning demand that has characterized China over the past fifteen years. For example, in 1993, some 254,000 enterprises paid about 2.7 Billion yuan in fees and fines, an average of only about 10,55 Yuan (approximately U.S. \$1,300 per firm).²⁷ Given that the average annual gross output for a state-owned firm is about 15 million yuan, this means that the typical Chinese state-owned firm faces fines and penalties of less than 0.1% of total revenue. This is in sharp contrast to the United States, where environmental compliance costs typically exceed 1% of total manufacturing costs.²⁸ The inadequacy of China’s fees and fines have prompted some

observers to call the imposition of such charges “a legalized non-compliance system” rather than a serious inducement to polluters to change their ways.²⁹

A second problem with the fees is that though they have raised a large amount in absolute terms, they pale in comparison with the amount needed to fund a serious clean-up. One study by NEPA has shown that the 13 billion Yuan in fees and fines collected since the program began represent at best the equivalent of what China has to spend each year to meet its established pollution standards by the year 2000.³⁰

In terms of institutional arrangements, China has set up environmental regulatory agencies at four levels: national, provincial, county and municipal. In 1984 the State Council of the Chinese government created the Environmental Protection Commission to oversee various environmental initiatives and programs. The Commission is composed of the heads of all ministries and agencies affected by environmental issues. In 1988 the Commission transformed the Environment Office of the Ministry of Urban and Rural Construction and Environmental Protection into a full agency, the National Environmental Protection Agency (NEPA). NEPA was given responsibility for environmental policy at the national level. Meanwhile, local (i.e. city and county) environmental protection bureaux (EPB's) were formed through the 1980's. As of 1990, NEPA employed some 300 people, while some 30 provincial EPB's employed 8,000, 366 municipal EPB's had approximately 24,000 staff, and 2,084 county EPB's had approximately 28,000 employees.³¹

In 1989 the original EPL was replaced by an updated version, which established programs encouraging factories to invest in cleaner technologies, and which provided for the financing of centralized treatment facilities. The new legislation also required certain larger firms to have in-house environmental monitors, thus reducing the burden on government officials charged with monitoring emissions. Another feature of the new EPL was the delegation of increased responsibility for certain environmental regulation to local officials.

In addition to national environmental regulations, several provinces have passed their own environmental protection statutes and regulations. There are also hundreds of local government laws and regulations pertaining to environmental protection and emission standards. However, despite a seemingly impressive

body of environmental legislation, enforcement has been, until the mid 1990's, generally poor. This is largely a function of limited resources devoted to hiring adequate numbers of inspectors, corruption at various levels of government, and conflicts of interest between local government ownership of certain businesses and local responsibility for enforcement of environmental laws. There are approximately 24 million such "township enterprises" which, according to some estimates, produce between 30 and 40% of the country's total output. These firms have been characterized by low levels of technology and high levels of emissions. For example, one Chinese government study estimated that township enterprises produced an average of 4.3 billion tons of effluent and 120 million tons of solid waste each year, while a survey of township enterprises in 1989 found that only 15% were in compliance with existing wastewater regulations.³² Clearly township enterprises pose a dilemma for local officials: Relaxation of environmental regulations and enforcement means higher output and thus more jobs and income for the community. It also means greater environmental degradation.

The Huaihe River basin

The 1,000 kilometer long Huaihe River, one of China's seven major rivers, runs through four provinces in eastern China (Anhui, Henan, Jiangsu and Shandong). Almost twenty million people live along its banks. The Huaihe River basin, covering an area of 270,000 square kilometers or one thirty-fifth of the entire country, is home to almost 150 million people (see exhibit 1). With over 13 million hectares under cultivation, the basin is one of China's most important agricultural areas, accounting for one eighth of total Chinese grain production and one fourth of total cotton production. Besides being a critical source of irrigation water for farming in the basin, the Huaihe River and its 191 tributaries have, for centuries, supported significant fishing and transportation industries (exhibits 2, 3). As well, the Huaihe River basin is characterized by frequent droughts, and groundwater sources are scarce. In fact, the average groundwater availability per capita in the basin is only one-fifth the Chinese average. Given the limited groundwater supplies, many cities and towns along the river have come to depend on it as a critical source of drinking water. The river has traditionally had a reputation for beauty and purity, as evidenced by the old folk rhyme "East or west, the Huaihe River valley is the best."

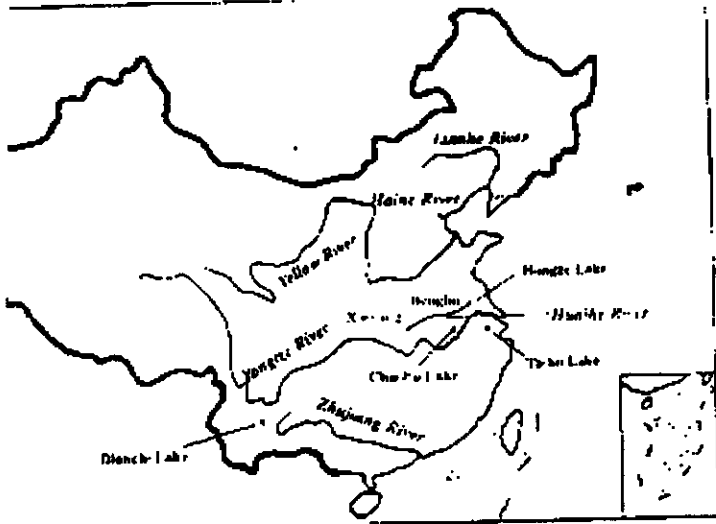


Exhibit 1: *Map of the People's Republic of China showing location of the Huaihe River and the city of Bungbu*

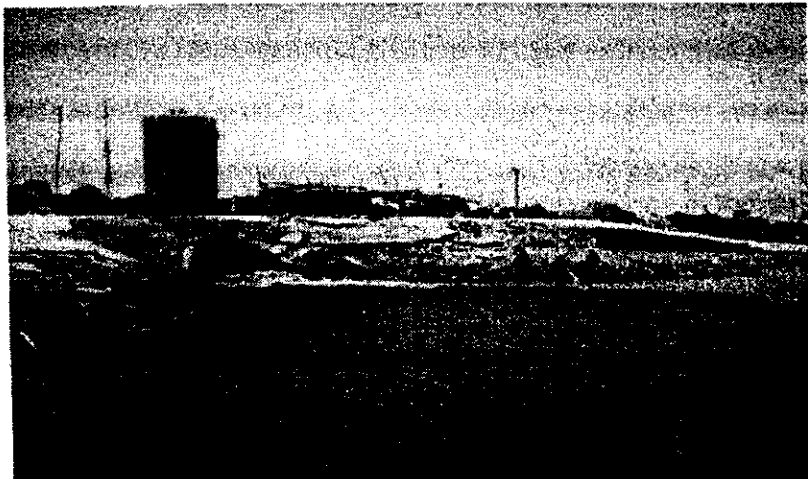


Exhibit 2: *Fishermen in the city of Bungbu catching fish in the Huaihe River, near outflow pipes .*



Exhibit 3: *Barge traffic on the Huaihe River near the city of Bungbu.*

However, as China's economy has moved into high gear over the past fifteen years, the Huaihe River has increasingly been used as a dumping ground for almost two hundred towns and thousands of factories along its banks. One estimate is that in a typical year almost 2.4 billion tons of waste has been dumped into the river and its tributaries. By 1995, almost half of the river's tributaries had been classified as seriously polluted (exhibit 4). The river itself could no longer be used as drinking water, and by early 1996 restaurants in Bungbu, Anhui province, a city on the banks of the river with about 500,000 inhabitants, had begun posting signs advising patrons that "We cook with mineral water".³³ Worse, pollution had reached the point where the waters of the Huaihe River could not even be used for irrigation.

Pollution of the Huaihe River has been exacerbated by the nature of industrial activity in the basin. Over the past fifteen years, the basin has become the center for a large agricultural processing industry concentrated in paper making and alcohol production. Both of these industries are heavy consumers of water and heavy producers of wastewater. One estimate is that the paper-making and alcohol distilling plants accounted for almost 70% of

total waste effluent in the basin. Moreover, most of the paper and alcohol plants in the basin have tended to be small, poorly capitalized businesses started either by townships or individual entrepreneurs, frequently farmers. These firms have lacked both the capital and the management know-how to adopt modern, efficient and clean production technologies. According to 1993 statistics, only 30% of all industrial effluent in the basin was treated, and of that figure only 40% could meet existing national standards.³⁴



Exhibit 4: Industrial effluent pipes emptying into the Huaihe River near the city of Bungbu.

The incidence of droughts also has had serious impacts on water quality in the basin due to several factors. Firstly, there are significant seasonal variations in the river flow. During dry season (November to March), the river slows from between 8,000 and 12,000 meters/second to as little as 50 to 60 meters/second.³⁵ If the wastewater enters the river at, say 30 meters/second, then during dry season and drought it can overwhelm the river's ability to handle some of it through natural breakdown and aeration. It is not uncommon during dry season for the ratio between river flow and waste effluent discharge to drop below 5 to 1, well below the level where the river could reasonably be expected to handle some of the wastewater.³⁶ As well, in order to mitigate the impact of droughts and floods, more than 4,200 hydraulic structures (dams or gates) have been built throughout the basin. As a result of this network, the water flow into the basin is largely artificially controlled.³⁷ During the dry season, there is a buildup of wastewater in the rivers various channels. With the onset of the wet

season, the gates along the river are at times opened to create storage facilities for flood prevention and for use during dry season. Similarly, during dry season, the gates may be opened in response to needs for more water downstream. However, the opening of the gates also releases tons of accumulated wastewater, with serious consequences for water quality downstream and major disputes between various water users.

The most dramatic illustration of the consequences of these periodic releases occurred on July 17, 1994, when dams were opened upstream of Bungbu in response to calls for more water from towns in the lower reaches of the river. The opening of the gates released largely stagnant and polluted water that contained the accumulated dumping of dozens of towns and factories all the way up to Henan province. The result was a huge floating slick of wastewater that made its way downstream toward Bungbu City. As one resident described the slick, "the water turned black like soy sauce and there was an awful smell".³⁸ Several thousand peasants and city dwellers in both Anhui and next-door Jiangsu province were treated for dysentery, diarrhea and vomiting. By July 20, the black tide had risen so high behind the dam at Bungbu that local officials decided, without warning downstream towns or fish farms, to release some 200 million cubic meters of the heavily polluted water. The result was an even larger slick that, by August 5, 1994, stretched almost 160 kilometers downstream. Fish farms as far as 500 kilometers away, in the Hongze Lake in Jiangsu province, were destroyed, and the river could not be used for drinking or irrigation for months afterward.

Water quality in the Huaihe River basin has also been the victim of lax enforcement of those environmental regulations which China has enacted. Most of the small paper and alcohol factories built on the banks of the Huaihe River were done with the full knowledge and consent of local officials who gave greater priority to the jobs and tax revenues which these plants generate, and who generally ignored the environmental consequences. Even in cases where existing environmental regulations were enforced, the outcome was at best minimal. The low level of fines for polluters meant, according to officials of the National Environmental Protection Agency (NEPA), that it was usually cheaper for a plant to continue polluting and pay the fines than to purchase the necessary clean technology.³⁹

The Huaihe River cleanup plan.

Efforts by the Chinese government to clean up the Huaihe River basin actually date back to the mid 1980's, when the State Council, China's highest governing body, issued an order banning fifteen types of small industries from the banks of the river. These included paper-making, tanneries, leather goods makers, distilleries, and machinery firms. However, enforcement of the order was practically non-existent, particularly at the crucial local level, where officials placed greater emphasis on economic growth than on environmental protection. During the 1980's and 1990's, many of the fastest-growing companies in China were so-called "township enterprises" which were wholly or partially owned by local administrative bodies. This development meant that many local authorities along the Huaihe River were in a conflict of interest situation whereby they were responsible for regulating the environmental impact of businesses which they had a direct stake in.

However, by the mid-1990's, the situation in the Huaihe River basin had deteriorated to the point where attitudes were changing among officials at all levels of government. Local officials began to see the economic impact of the ongoing degradation of the river in terms of lack of drinking water and the expenses associated with constructing treatment plants, as well as in terms of the threatened destruction of the fishing and agricultural activities which the river used to support.

The State Council visited the basin three times, holding two meetings in the city of Bungbu and one in Jiangsu province to discuss the situation. As a result of these visits, in 1994 the State Council ordered NEPA to begin conducting regular inspections of water quality in the Huaihe River basin. Then, in early 1995, the State Council asked NEPA to prepare a comprehensive plan for the cleanup of the Huaihe River. NEPA assigned the task of developing the plan to its affiliated research institute, the Chinese Research Academy on Environmental Science (CRAES). Throughout 1995, CRAES worked on developing the plan, and sought the input and endorsement of various government ministries that would be impacted by its provisions, notably the Ministries of Agriculture and Water Management. In March, 1995, the plan was presented to the State Council, which adopted it on June 29, 1995. On August 8, 1995, Chinese Premier Li Peng signed a State

Council Executive Order outlining the plan's objectives, and putting in place stiff legal sanctions for industrial polluters.

According to the State Council Order, all industrial polluters were to meet national standards by 1997, and the Huaihe River was to be "completely clear" by the year 2000. This meant a reduction of the almost 1.2 million tons of pollutants dumped in the river in 1995 to about 450,000 tons by the year 2000. In terms of Chemical Oxygen Demand (C.O.D), pollutants in the river would have to be reduced from the pre-plan level of 150 million parts per million (ppt) to 90 million ppt by the end of 1997, and to 37 million ppt by the year 2000. [COD measures the amount of oxygen required to decompose chemical material under specified conditions of temperature and time] At the level of C.O.D. planned for the year 2000, the waters of the Huaihe River would be fit for drinking.

The plan developed by CRAES focused on eighty-two sections of the river, which were selected on the basis of being representative of drinking water sources at various points along the river. These sections would be regularly monitored in terms of their water quality and the amount of COD. A special control group, lead jointly by NEPA and the Ministry of Water Management, was given overall responsibility for coordinating and supervising execution of the plan. The four provinces in the Huaihe River basin were ordered to amend their existing pollution controls to conform to the new plan and, in conjunction with local environmental authorities, were given the primary responsibility for ensuring compliance with the plan and attainment of its objectives. The State Planning Committee and the Ministry of Finance were charged with arranging financing for the various projects called for under the plan, with the Construction Ministry put in charge of organizing the actual construction work.

The plan identified some 227 priority projects, including construction of up to 47 new wastewater treatment plants in the basin, and the installation of pollution abatement technologies in approximately 150 large enterprises throughout the basin. The plan outlined the following prioritization for allocating funds to support various projects associated with the plan:

First priority: Projects directly affecting drinking water sources.

Second priority: Projects affecting water removed from but ultimately affecting drinking water sources.

Third priority: Projects which had a high demonstration effect.

Fourth priority: Projects offering a high ratio of environmental benefits to economic costs.

Initial estimates were that the program would cost approximately 11 billion Remninbi (about U.S.\$1.3 billion). This amount would be raised from the following sources:

World Bank loan	3.3 billion Rm (approx. U.S. \$410 million)
Foreign government loans	545 million Rm (approx. U.S. \$70 million)
Loans from State Development Bank	1.03 billion (approx. U.S. \$130 million)
Direct investments from	
various state entities	50 million (approx. U.S. \$6 million)
Loans from Local sources	5.676 billion. (approx. U.S. \$710 million)

According to the plan, World Bank and foreign loans would be earmarked for the construction of regional sewage treatment plants and for funding various large-scale clean production processes for both pulp-making and leather processing. Foreign government loans consisted of funds from countries such as Germany, the Netherlands, Japan and Denmark, directly tied to the purchase of pollution abatement or clean production technologies from the lending country. These loans were made directly to specific provinces. For example, Hunan province received a direct loan from Japan, while Shandong received a loan from Germany. Meanwhile, loans from the State Development Bank (SDB) would be mainly allocated to funding the installation of pollution abatement or clean production technologies in large- and medium-sized state enterprises.⁴⁰

These sources would supplement a sizeable pool of local funds. These were derived from fines which local authorities had collected over the years from polluting firms. As noted earlier, when China's economy took off during the 1980's and 1990's, many firms in the Huaihe basin and throughout China found that it was

cheaper to keep on polluting to meet burgeoning demand and to simply pay the fines imposed by local authorities under the country's "polluter pays" laws. As a result, several local environmental bodies had accumulated significant sums which they could now use to lend to businesses required to install pollution control equipment. For example, in September, 1996 environmental officials in Jiangsu province announced that the province would allocate up to 43 billion yuan (approx. U.S. \$5.4 billion) on environmental projects by the year 2000.⁴¹

While there appeared to be ample funds available to fund the cleanup plan, not everyone in China was pleased with the way the financing was being arranged. Some members of the State Planning Commission were uneasy with incurring significant foreign debt, regardless of how worthy the use of funds. Looking ahead to the day when the Renminbi would be freely convertible on international money markets, one Chinese academic noted that "there are people [in the government] who do not want China to become another Mexico. They ask 'how will all these foreign loans be repaid and at what cost?'. This was a clear reference to Mexico's difficulties in servicing its massive foreign debt following the sudden fall in the value of the peso in early 1995. In fact, the World Bank and foreign government loans earmarked for the Huaihe River plan were part of a larger overall package of loans aimed at environmental improvements in China. For example, in March 1997 Anhui province received a U.S. \$140 million loan from the Asian Development Bank (ADB) for pollution abatement in the Chaohu Lake region.

In addition to the overall goal of making the Huaihe River drinkable again by the year 2000, the plan established four secondary goals. These were:

- 1) Ensuring that existing sources of pollution met one of the three levels of existing national standards by the end of 1997;
- 2) Establishing maximum allowable levels of effluent for each of the main sources of pollution in the river, allowing for the relevant national standard applicable to that source and the river's flow rate at the source in question.

3) Establishing clear pollution reduction targets and stages by which these targets are to be met, for each province and city in the basin.

4) Eliminating the most serious industrial pollution by enforcing the closure of all small pulp making plants and tanneries in the basin before June 30, 1996.

The fourth objective was the most dramatic proof that Chinese authorities were indeed serious about cleaning up the Huaihe basin. During 1994 and 1995, some 2,000 extremely small-scale paper mills along the river had already been closed by authorities in the basin's four provinces in an effort to stop some of the most egregious cases of untreated wastewater entering the river. However, the new master plan went further, ordering the closure of any paper mill with yearly output below 5,000 tons by June 30, 1996. To enforce its order, the State Council froze bank loans to the targeted companies and had all electrical flows to them cut off. The order resulted in the abrupt closure of 1,111 small mills. In justifying the sudden action, officials noted that almost 70% of wastewater discharged into the river came from two industries, paper making and distilling, and that small plants were unlikely to have the financial resources needed to install cleaner production technologies.

Though small-scale tanneries were also included in the closure order, they received a reprieve in early 1996, when the Chinese government announced the development of a new technique to treat wastewater produced in the processing of leather goods. The technique would allow almost 90 per cent of the tanneries' processing liquid to be re-used. The government's initial announcement indicated that more than 1,000 tanneries, most concentrated in central Henan province, would be spared from immediate closure as called for by the Huaihe River plan.⁴²

The forced closure of the 1,111 small-scale paper mills along the Huaihe River was all the more dramatic given the state of the Chinese paper market. Though China ranked third in the world in annual pulp production in 1996, with installed capacity of 15 million tons, the country faced a severe shortage of certain grades of paper.⁴³ With ever-increasing economic activity, more and more Chinese firms required paper to conduct business, and demand for paper increased exponentially through the 1990's. The paper shortage was

particularly acute for high quality office and printing paper, and as a result China was forced to import more than 3 million tons of paper and paperboards, 800,000 tons of pulp and 900,000 tons of waste paper in 1995 alone.⁴⁴ In response to the tight market, over 21,000 small and mid-sized paper plants opened during the 1990's, creating almost 1.2 million new jobs.⁴⁵ Unfortunately, these firms were generally poorly equipped and lacked pollution-monitoring or pollution-control equipment. A 1992 survey on industrial pollution revealed that the 3 billion tons of waste liquid discharged from China's paper mills represented fully one-eighth of total industrial pollution in the country.⁴⁶

The closure of the small-scale plants resulted in between 100,000 and 200,000 workers losing their jobs. However, as noted by officials of NEPA, CRAES and the local EPB in Bungbu City, Anhui province, over 90% of these workers were farmers who would simply return to their farms. In fact, both NEPA representatives and local environmental officials in Bungbu city were quite nonchalant about the lost jobs, noting that those ex-paper mill workers who did not return to their farms could easily find alternative work in one of the area's larger factories.

The closures also affected China's banks, many of whom faced millions of dollars in losses as borrowers were forced to close by the Huaihe River plan's implementation. The state-run Agricultural Bank of China and the Agricultural Credit Cooperative faced combined write-offs of almost U.S. \$20 million in loans to small-scale paper mills just in the Huaihe River basin.⁴⁷ The Agricultural Bank of China was one of four specialist banks spun off from the Peoples Bank of China, the country's central bank, in the 1980's. A publication put out by NEPA describing some of the impacts of the Huaihe River plan estimated that loans to small-scale paper mills targeted for closure represented as much as one-third of all loans at the Agricultural Bank, and up to 70% of credits at the Agricultural Credit Cooperative.⁴⁸ The publication went on to criticize the banks for making loans "without giving due attention to possible environmental pollution."⁴⁹ The Agricultural Bank, like its three sister institutions spun off from the People's Bank of China, was under strict orders to reduce non-performing loans from over 20% of total portfolio to below 10% by about 2004.⁵⁰ Despite grumbling from the banks, however, the forced closure of small scale paper plants along the Huaihe River proceeded. As one senior NEPA official stated matter-of-factly, "they [the banks] had to obey...they had no choice."⁵¹ At the

same time that some bankers were expressing concern over enforced loan losses, officials at China's State Development Bank were announcing that they would deny credit applications from firms and projects which failed to meet its requirements for environmental protection.⁵²

The future of the Huai River Plan

Even as the Huai River cleanup plan moved forward in mid-1997, many unanswered questions remained. The first step - the forced closure of some 1,100 small paper mills along the river - had been relatively easy. However, how to handle larger plants along the river was a more complex issue. The plan called for some 1,000 medium- and large-scale factories along the river to upgrade their production technologies and pollution abatement equipment. Several large firms contacted by representatives of CRAES to determine what type of equipment would have to be bought indicated that they did not want their firms to carry additional debt associated with the purchase of new equipment. Fears about the affordability of clean production technology and the impact of massive new investments in such technologies were also being expressed by members of the State Economics and Trade Commission, which was responsible for control of state-owned enterprises. These concerns will, according to CRAES officials, become more salient as China continues its efforts to enter the World Trade Organization (WTO). If and when China does enter the WTO, Chinese firms will face an increasingly competitive market, as foreign-made goods gain greater access to China.

Another question mark was the fate of workers at many of the medium- and large-scale firms in the basin, since the plan called for the shutdown of any firm which did not comply with applicable standards by the year 2000. The plan made local planning commissions responsible for placing any workers from medium- and large-scale plants who lost their jobs as a result of the river cleanup. However, no local authority had yet to issue any plan or statement about how displaced workers would be dealt with.

Some of the larger firms in the Huai basin have already begun to purchase and install upgraded clean production technology. Typical of these firms was the Bungbu Paper Factory, a forty year old state-owned

plant in the city of Bungbu. The company's original equipment generated a significant amount of effluent, which was dumped directly into the Huai River . In late 1995, the firm stopped all pulp-making operations in response to an order from local officials, and in June 1996 the paper making line was shut down completely. In its place, the company purchased American-made paper making machinery which, once operational in the fall of 1997, would completely eliminate the dumping of wastewater into the Huai (see exhibit 5). Purchase of the equipment was financed partially by the plant's own funds and partially by a loan from the local Environmental Protection Board (EPB). However, whereas the old technology required 1,100 employees to operate, the new cleaner machinery only needed 250 workers. The plant's manager, Mr. Du, insisted that his firm would find jobs for the 850 surplus workers. The factory had already announced plans to open a store and a warehouse which could be used by other local businesses. However, Mr. Du conceded that he did not yet know where all of the 850 surplus workers would be placed.

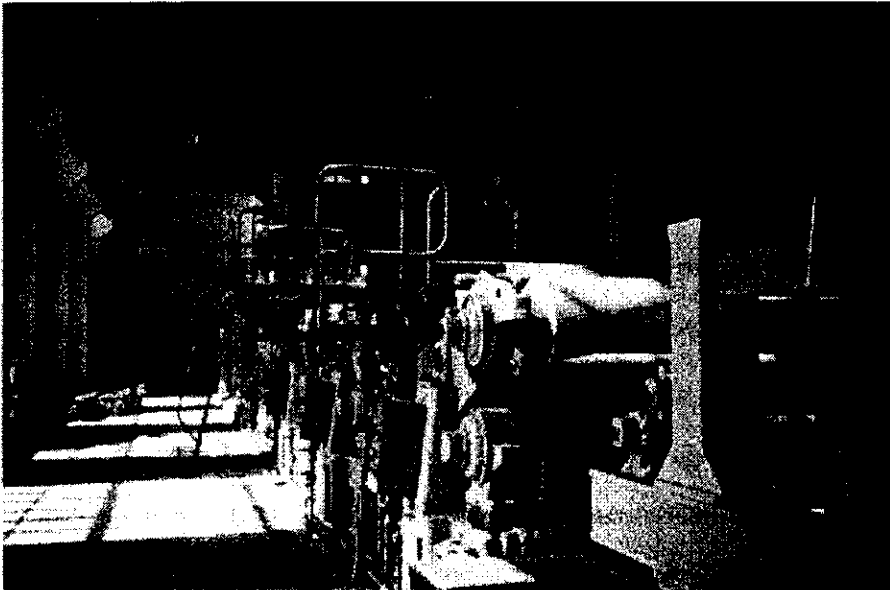


Exhibit 5: New clean paper making machinery being installed at a paper plant in the city of Bungbu.

Control of the cleanup plan after the year 2000 was also uncertain. For now, NEPA was officially in charge of the plan. However, the Ministry of Water Management remained the source of data on water quality, and would be an important bureaucratic player as the plan unfolded. The Ministry of Finance was also monitoring implementation of the plan, as it was concerned about repayments of loans made by various firms and

municipalities for pollution abatement equipment. The plan did not indicate which ministry would take over running the plan after the year 2000, and several observers expressed fears that bureaucratic infighting could paralyze its future enforcement.

Will the plan succeed?. The Executive Director of the Beijing Environment and Development Institute (BEDI), a private think tank devoted to environmental issues, told the authors that the plan would ultimately succeed "because it must", implying that Chinese officials will do whatever is necessary to meet the plan's ambitious objectives. Other observers are not so sanguine. Several large manufacturing firms in the basin have already complained about the substantial investments the cleanup plan will require of them. Moreover, there are a number of ministries and government agencies either directly or indirectly involved in the execution of the plan, and they do not necessarily share NEPA's environmental concerns. Finally, there are the uncertainties looming over China's future direction. Can the country maintain the rapid economic growth of the past fifteen years, while dealing with the environmental impacts which growth has already had? The country's huge population creates another element of uncertainty hanging over the Huaihe River plan. Can China's government balance the sometimes competing demands of promoting jobs while protecting the environment? How can the Huaihe plan and other similar environmental repair projects be financed in a way that does not saddle China with a crippling foreign debt? The success or failure of the plan to clean up the Huaihe River basin will provide an important indication of how these questions will be answered.

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Teaching Note

The case examines the Chinese government's plan to clean up the Huaihe River and its surrounding basin. The plan occurs against a backdrop of rapid economic growth in the People's Republic of China, accompanied by large-scale environmental degradation. The plan's significance to foreigners is threefold. Firstly, the Huaihe River basin clean-up plan is a microcosm of the broader question of whether or not China will be able to deal with its massive environmental problems in order to avoid a large-scale crisis. The implications for China and its neighbors of a major environmental crisis – in particular the exhaustion of drinking water supplies – have to be considered. The plan's implementation is predicated on a significant level of foreign involvement, both in terms of the sale of pollution abatement equipment and expertise, and in terms of large-scale loans from various multilateral and national institutions.

The Huaihe River is almost 1,000 kilometers long, and runs through four of the country's eastern provinces. Almost twenty million people live along its banks. The basin, covering almost 270,000 square kilometers or one thirty-fifth of the country, is home to almost 150 million people. The Huaihe basin is one of the most important agricultural areas in China, accounting for one-eighth of total Chinese grain production and one-fourth of total cotton production. The river and its tributaries have traditionally supported large fishing and transportation industries. As well, given the limited groundwater supplies in eastern China, the river has always been a key source of drinking water for many of the urban areas along its banks.

The case begins by discussing the connections between economic development and environmental degradation. The case then describes the major environmental problems which China is facing, and what measures it has taken to date in dealing with them. In the next section, the case focuses on the Huaihe River and its basin, describing its importance and the situation which Chinese authorities faced when they devised the plan. Finally, the case describes the plan, the implementation of its initial steps in 1996 and 1997, and outlines some future issues which may affect the plan's success.

Using the Case in Different Courses

Economic Development

The case is an ideal vehicle for demonstrating some of the trade-offs which developing nations have to make as they attempt to industrialize. The perils of simply ignoring "soft" environmental issues in favor of "hard" issues such as jobs and economic growth are amply illustrated, as Chinese authorities find themselves having to spend large sums, much of which is borrowed from above, to pay for the mistakes of the past. The case also illustrates the interactions among different stakeholders that occur in a developing country as it tries to reconcile continued economic growth with environmental protection.

International Economics

The case also illustrates another level of the interconnectedness of countries in today's global economy. The trans-national impacts of China's looming environmental crisis are raised, as are the potential opportunities for foreigners as China ramps up to deal with it.

Teaching the case

There are several ways the case can be used, depending on the amount of time which instructors wish to devote to it. One way is to focus on the suggested discussion questions given below. Another is to devote one class session to the general question of the connections between environmental degradation and economic growth. The case's opening section can be used as an initial baseline reading for a short student research project. Students can be asked to examine other areas of the world where breakneck economic growth has had serious environmental consequences, and to present these to the class. Areas such as Eastern Europe, the former Soviet Union, and parts of Asia such as Indonesia and Taiwan come to mind.

Instructors can devote this first class session to comparing the environmental impacts which the student-researched areas have experienced with those described in the case for the PRC. The second class session can then focus on the specifics of the Huaihe Plan, either using the suggested discussion questions or comparing cleanup efforts which may be underway in any of the areas researched by the students.

Suggested Discussion Questions

1) *What are some of the obstacles to sustainable development and environmental protection in developing countries such as China?*

Students should focus on the need to create jobs for China's huge and growing population; the overcrowding of the country; adverse natural factors including flooding, droughts, and soil erosion; China's continued reliance on coal to meet its ever-growing energy needs; and the country's limited resources to deal with the problem. Other factors include the lenient "polluter pays" laws, which effectively allow firms to continue polluting while paying negligible fines, the vested interests which some local authorities have in continued output by the "township enterprises" in which they have a direct stake, and the bureaucratic turf battles which may handcuff serious environmental action.

2) *Is the real increase in affluence in China part of the problem or part of the solution when it comes to environmental problems? Why?*

Too often, high fertility is blamed for problems that are attributable to poverty itself. For example, China's population density per acre of arable land is twice that of India, yet

yields are also twice as high. Though it is clear that environmental destruction and high fertility go hand-in-hand, they are both direct out-growths of a third factor, absolute poverty. For environmental policies to succeed in China, they must first address the issues of landlessness, poverty, and lack of access to institutional resources. Students should point out that the dirtiest factories along the Huaihe River were the small paper plants started by farmer-entrepreneurs, who started these factories in an attempt to improve their meager standards of living but who lacked the financial resources to install clean technologies. Absent direct aid from the Chinese authorities to these small factories to help them upgrade their production processes, the only way to really begin cleaning up the river was to close them.

If, in fact, if it is possible to reduce environmental destruction by increasing the incomes of the poor, is it then possible to achieve economic growth without further damage to the environment? There is ample evidence which indicates that the worst perpetrators of environmental destruction in China are the richest and the poorest people. (It has even been suggested that the bottom billion of world population are more destructive than all 3.2 billion middle-income people combined.)

Thus, increasing the economic status of the poorest group would provide an environmental windfall, however, as the income and consumption levels of everyone else in the economy also rise, there is likely to be a net increase in environmental destruction, at least in the short-term. For example, students will point out that as China's economy continued its strong growth, the demand for paper skyrocketed, thus creating the conditions which promoted the establishment of all the small paper factories along the banks of the Huaihe River. As income increases in China with continued economic growth, the case suggests that the country will be able to marshal the resources for a serious environmental cleanup. Clearly, meeting increasing consumption demand while keeping environmental degradation at a minimum will be no small task for China. Solving many of their future environmental problems will require raising standards of living. However, following the path of development pioneered by the industrialized nations is probably not possible without triggering severe environmental problems; the solution would become the problem.

3) How does the implementation of a cleanup plan such as the one for the Huaihe River basin differ when it is done in a developing country such as China as opposed to a developed country such as the United States? What unique political, economic and social factors exist in the developing country case?

Students should be directed to the differences in priorities between developing and developed countries. In particular, the imperative for China is strong economic growth to provide jobs and a rising standard of living for its huge and ever-increasing population. Students will probably recognize that this priority means that environmental protection takes a much lower priority among policy makers than is the case in a developed country. At the same time, students will note that access to clean and safe drinking water, something taken for granted by residents of developed countries, is far from assured for those living in developing countries. The health consequences of disregarding

environmental impacts in favor of jobs and income are all too visible to the people living along the banks of the Huaihe River.

Students will also point out the fact that since China is still a developing country, it does not have the resources that developed countries such as the U.S. have to deal with an environmental problem. This means that China has to turn to foreigners, both in terms of financial and technological resources. The fear of being in debt to foreigners is a factor in Chinese calculations of what are the true costs of a serious environmental cleanup.

4) What is the stake of the developed world in the success of the Huaihe River basin cleanup plan, and of other efforts to reverse environmental damage in China?

The impacts of China's environmental problems on its neighbors should be discussed. These range from acid rain emissions over Japan to potential impacts on oceans as polluted Chinese rivers reach the sea. The broader enviro-security issue could also be raised. What are the implications for political stability in China if and when it runs out of drinking water or water suitable for irrigation?

Students can be expected to focus on the huge market which China offers for the sale of environmental technologies, equipment and expertise. These would include not only pollution monitoring and control equipment, but also so-called clean production facilities for a range of industries, such as the U.S.-made clean paper-making technology being installed in the Bungbu plant described in the case.

Finally, the discussion can deal with the issue of China's foreign borrowings to finance cleanup efforts. What will these loans mean to the country as it moves to make its currency freely convertible on world markets?

5) Does the fact that the Chinese government exerts such an influence in the economy increase or decrease the chances that the Huaihe River cleanup plan will succeed?

Students should point out the significant involvement of government at various levels in the workings of the Chinese economy and society. In particular, students should identify the fact that at the national level, the Chinese government is the owner of most large-scale firms and so is responsible for much of the emissions. At the same time, the Chinese government possesses dictatorial powers, and so is able to shut down polluters by decree without the fear of court challenge by business owners. Adding to its power, the Chinese government controls the banking system, and is in a position to cut off credit to polluting firms while funneling funds to finance cleanup efforts.

The fact that the Chinese government is a dictatorship which does not have to concern itself with individual property rights, at least as far as Chinese citizens are concerned, the fact that it owns many of the firms directly contributing to the environmental problem, and the fact that it controls both the banking system and the electrical grid give it tremendous leverage in insuring that the Huaihe plan succeeds. At the same time,

students may point out that this tremendous power is a double-edged sword. The Chinese government, like governments everywhere, has various ministries and agencies, some of whom may not share the goal of environmental protection. As the case points out, some of these ministries and agencies may be in a position to torpedo the plan's implementation if they perceive it to be inimical to other priorities, such as economic growth or avoidance of foreign debt.

At the local level, students should point out that local officials also own businesses in the form of the township enterprises, and operate Environmental Protection Bureaus (EPB's), something not done in the United States. The conflicts of interest created by this dual role should provide the basis for an interesting class discussion, especially if instructors ask students to identify government-owned entities in the United States that are major sources of pollution.