FEATURE ARTICLE

Is Guangdong the Dark Horse in Addressing Ecological and Human Health Threats?

By Kaleb Brownlow and Stephanie Renzi

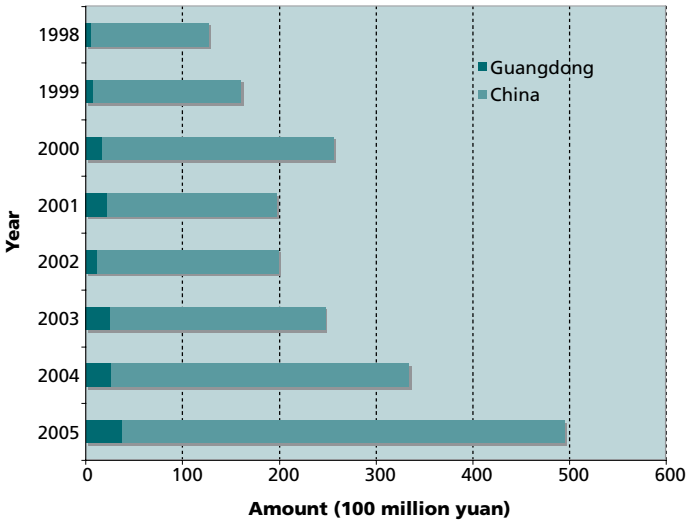
In 2006, Guangdong Province recorded its worst air pollution in decades despite continued government promises to address the problem. That same year, the average number of smoggy days (e.g., visibility below 10 kilometers) reached 120 in major cities such as Guangzhou. Not surprisingly the number of people suffering from respiratory illnesses spiked in 2006 as well. Guangdong also confronts serious water pollution problems from poorly regulated industries and an abysmally low rate of municipal wastewater treatment. The provincial environmental protection bureau received about 80,000 pollution complaints in 2005, most of which were related to water pollution. In 2006, slightly more than 40 percent (22 million) of Guangdong's rural population did not have access to safe drinking water. These poor air and water quality trends represent serious threats to economic growth and human health in Guangdong. In 2006, Guangdong invested more than 60 billion Yuan into environmental protection, which equals approximately 2.5 percent of the province's gross domestic product (GDP)—a ratio significantly higher than that of most other provinces. Besides investment, there are signs of progressive environmental policies within Guangdong, such as growing partnerships with the research communities and government of Hong Kong to work on air quality monitoring, pollution policy development, and even a pilot SO_2 emissions trading program. Guangdong was entrepreneurial in pushing China's free-market reforms, so it is possible (indeed crucial) that the province's growing ecological crises will spark it to become the vanguard for protecting the environment and human health. This paper explores Guangdong, highlighting both signs of emerging leadership in the environmental health realm and the province's failures to be green.

THE SIHUI CITY INDUSTRIAL PARK CASE

China's environmental degradation is often lamented as the byproduct of a dysfunctional environmental governance system mired in conflicts of interest and fragmented lines of authority. There can be little disagreement that China falls far short when it comes to the implementation and enforcement of environmental regulations. Evidence of this abounds at both the national and the local level. Guangdong's experience with the Sihui industrial park pollution case provides yet another testament to weak enforcement; yet the case also hints at a new kind of stricter oversight by the provincial people's congresses. As such, understanding the events surrounding the Sihui case is critical to begin pondering whether Guangdong might prove to be a vanguard for China's environmental health.

In mid-1999, two ecologically interdependent cities located in Guangdong Province found themselves in a heated dispute over the construction of 19 electroplating projects to be built in the city of Sihui within Zhaoqing municipality. Foshan municipality, situated downstream from Zhaoqing, contested the construction of the factories on the grounds it would contaminate their communal water system, violating two water pollution regulations. Foshan's deputies in the Guangdong Provincial People's Congress (PPC) spearheaded this charge, further arguing that construction of the factories should not have been approved in the first place because the local environmental protection bureau (EPB) had not conducted an environmental impact assessment (EIA) (Wang & Wang, 2006). Months of congressional inquiries and infighting between the Foshan and Zhaoqing PPC deputies and the municipal EPBs and executive governments ensued, with each group jockeying for legal jurisdiction to determine the outcome of the case.

FIGURE 1: Investment in Industrial Pollution Control



Source: Drawn from 1999 to 2006 issues of the China Statistical Yearbook.

Although the PPC deputies on each side were asserting their constitutional right to inspect the enforcement of the law, such congressional inquires had never before occurred around a pollution case in China (Wang & Wang, 2006). As such, these actions represented a decisive break from the traditional "rubber-stamp" role of the PPC. In the end, the provincial government had the final say and chose to allow the construction of nine out of the original 19 projects, signaling that concessions were made on both sides of the dispute. Given this outcome, it is clear Guangdong's local environmental governance is still far from perfect. Nevertheless, the case succeeded in elevating public awareness of environmental issues and pioneering new congressional practices (Wang & Wang, 2006). It is also likely that these nine new plants will be carefully monitored for their emissions.

Despite debate over exact numbers, many Chinese and international environmental specialists agree that two decades of a booming economy have drastically worsened air and water quality. Some of the pollutants contaminating air and water have contributed to declining health and increased non-communicable disease (NCD) (e.g., cancer, cardiovascular disease, and diabetes); morbidity; and mortality in China. As Chinese government officials, researchers, and the public struggle to mitigate the harmful effects of environmental degradation, they have become increasingly aware of the negative impact air pollution has on health and social stability (Cheng, 2006). Over the past few years, China's central government has begun to promulgate more aggressive pollution control laws—some even giving more power to the public to monitor dirty industries—and recently developing an, albeit general, National Environmental Health Action Plan. Key to the success of such laws and environmental health initiatives will be the support of local governments, which are often the greatest obstacles to environmental law enforcement. Ultimately, for China to make a breakthrough in halting the skyrocketing pollution levels threatening human health within—and even beyond—China there must be a major shift in the attitude and performance of local governments to fully implement environmental protection laws and regulations. This paper explores Guangdong, highlighting both signs of emerging leadership in the environmental health realm and the province's failures to be green.

EXAMINING THE POLLUTION AND HEALTH NEXUS IN CHINA

Throughout the reform era, many health indices have improved considerably: life expectancy rose from 60 in 1970 to 72 years in 2007; between 1991 and 2003 infant mortality rates decreased from 50.2 to 25.5 per 1,000; and during the same time period the maternal mortality rate decreased from 94.7 to 51.3 per 100,000 (Mao, 2005a). These marked health improvements have shifted the disease burden from primarily infectious diseases to chronic, non-communicable diseases (NCD), which include cardiovascular disease, respiratory disease, and cancer. An aging population, changing lifestyles and behaviors, and environmental pollution represent key factors contributing to increased NCD and mortality rate. One study found 131.39 million disability-adjusted life years (DALYs) were lost due to the disease burden of NCDs in 2002, which is equivalent to 64.36 percent of the total disease burden in China (Mao, 2005b). This figure has grave implications for the health of China's society and its ability to sustain an efficient labor force. In rural areas, respiratory illnesses, many caused by indoor air pollution, are the leading cause of death. (See Table 1).

Large regions across China experience varying degrees of air pollution. A 2003 survey of 341 major cities, undertaken by the Chinese Academy on Environmental Planning (CAEP), reported that

"27 percent suffered from serious pollution, 32 percent had light pollution, and 41 percent enjoyed good air quality." Moreover, CAEP claimed air pollution caused 411,000 premature deaths, mostly due to lung and heart-related diseases, while the World Bank claimed this number could be as high as 750,000 (McGregor, 2007). The study highlighted other pollution-linked illnesses such as increases in childhood and adult asthma, chronic obstructive pulmonary disease (COPD), and a host of respiratory diseases afflict millions of Chinese. There are approximately 38 million Chinese suffering from COPD, with nearly 100,000 deaths each year ("China sets up an alliance," 2006).

Today in China there is an increasing prevalence of lung cancer, which now captures the greatest share of cancer-related deaths. Between 2000 and 2005, the incidence of lung cancer in men and women increased 26.9 and 38.4 percent, respectively (Yang, Parkin, Ferlay, Li, & Chen, 2005). Future projections of lung cancer cases remain equally grim, with approximately one million Chinese expected to suffer from lung cancer by 2025. According to Zhu Xiuyi, a director of a lung cancer treatment center, "Smoking and pollution are two major causes of the high rate of lung cancer [in China]" ("Lung cancer cases," 2007). Air pollution, if controlled and reduced, could ameliorate the situation and reduce the disease burden from lung cancer and a host of other respiratory diseases.

ENVIRONMENTAL HEALTH AS A GROWING PRIORITY

Over the past few years, the Chinese government has increased its prioritization of environmental projects, policies, and investment (see Figure 1) with certain cities or regions making some strides in reducing and controlling pollution. In preparation for the 2008 Olympic Games, Beijing has invested $12 billion over ten years to clean the city's notoriously dirty air and water, shutting down or retrofitting 200 dirty industries in the city, and making plans to keep 1.3 million cars off the roads for the entire two weeks of the Games. While Beijing is experiencing many more days of blue skies, it is unclear whether all the efforts have been enough to guarantee clean air for the Games, as regional pollution from coal and cars could nullify much of the progress (Turner & Ellis, 2007). Beijing's struggles are mirrored nationwide, for despite increasingly progressive energy laws, stringent energy efficiency requirements, and experiments in SO_2 emissions trading, many airborne pollutants were not reduced to levels required in the Tenth Five-Year Plan (2000-2005). Even the first-year energy efficiency and SO_2 emissions goals under the Eleventh Five-Year Program, which the party leadership had prioritized, were not met.

TABLE 1. Leading Causes of Death in China, 2005

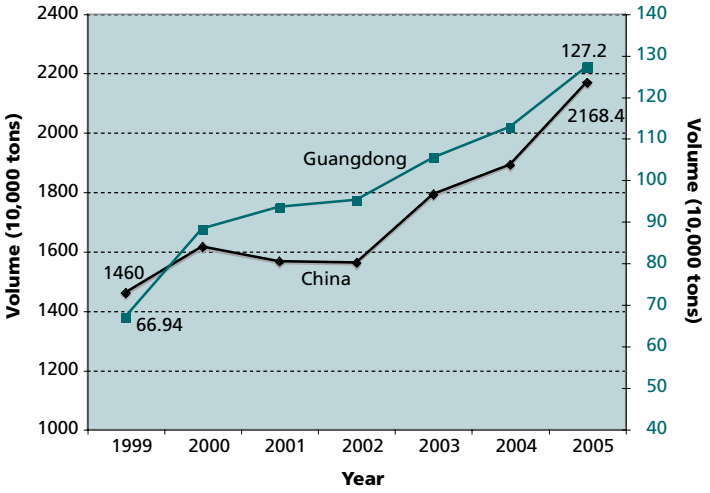
Urban		Rural	
Disease	**%**	**Disease**	**%**
Malignant Tumor	22.94	Respiratory Diseases	23.45
Cerebrovascular Diseases	21.23	Cerebrovascular Disease	21.17
Heart Diseases	17.89	Malignant Tumor	20.29

Source: China Statistical Yearbook (2006).

China's State Environmental Protection Administration (SEPA) has been flexing its muscles of late, publicizing its studies on highly polluting industries and becoming more forthcoming in announcing the economic and health costs associated with pollution. In 2004, SEPA estimated the economic losses from pollution amounted to a staggering $61.8 billion or 3.05 percent of total GDP, of which air pollution accounted for 42.9 percent or $26.54 billion ("Green GDP," 2006).[1] Other unofficial reports indicate the cost could be as much as 8 to 12 percent, which is roughly equivalent to the country's annual economic growth (Landwehr, 2006). After decades of unfettered economic growth, the Chinese central government leadership is faced with significant challenges regarding environmental degradation and health issues, which has galvanized them to more aggressive pronouncements and policies, and permit SEPA to take more stringent steps to address environmental problems.

While there are rumors SEPA will be elevated to ministry level in 2008, the agency is still small and under-funded. Nevertheless, SEPA has become resourceful in wielding increased power under the new environmental impact assessment law, as well as pushing public participation, information disclosure,

FIGURE 2. Total Industrial SO_2 Emissions in China & Guangdong (1999-2005)



Source: *China Statistical Yearbook*, 1999-2006
Note: In 2006, The Guangdong provincial EPD reported that the emissions of sulfur dioxide dropped to 1.26 million tons from 1.29 tons in 2005 (Xinhua, 2007).

and green GDP accounting—all strategies that put more pressure on local governments. The ambitious green GDP effort failed, but it did raise the issue of local government accountability to a higher level and the National Development and Reform Commission (NDRC) now has set energy efficiency performance standards for local governments, with its Deputy Director Zhu Hongren asserting that "we are left with no other alternatives but to meet the targets" ("Energy saving," 2007). As part of SEPA's new and more aggressive stance, SEPA Minister Zhou Shengxian promised that "the implementation of environmental policies will be as forceful as steel, not as weak as tofu" (Yuankai, 2006). However, without concrete action to prove otherwise, Zhou's words will prove as superficial as the countless government statements on environmental protection made before.

The lead feature article in this issue of the *China Environment Series* introduces many of the main central government and international initiatives that are beginning to address the growing environmental health challenges in China. Most of these efforts are uncoordinated, but we wish to highlight one, which offers promise of improving collaboration among central government agencies to environmental health problems. Namely, the WHO/UNEP Regional Initiative on Environment and Health in Southeast and East Asian Countries,[2] which since 2005 has catalyzed a number of forums in China. These forums have enabled China's Ministry of Health (MOH) and SEPA to create an environmental health action plan for the country and have prompted the two agencies to develop information-sharing platforms and mechanisms to integrate inter-ministerial efforts on quantifying environmental health indicators. The two agencies also are designing joint responses to environmental health emergencies (Duan, 2007; "China's environmental," 2007). In 2006, these two agencies sought to establish standards on the most prevalent and harmful pollutants (cadmium, fluoride, arsenic, and mercury). Additionally, SEPA is currently trying to establish specific standards for evaluating the impact of lead pollution on human health, particularly on children ("China to set," 2006; Information Office of State Council, 2006). Better coordination on environmental health could help provide a catalyst for entrepreneurial local governments to begin to address this issue more constructively.

GUANGDONG'S DOWNWARD TREND

Similar to China's national situation, environmental degradation and declining public health are byproducts of Guangdong's impressive economic success and weak environmental enforcement. Particularly evident are the effects air pollution (e.g., coal smoke, suspended particulates, sulfur dioxide, and vehicular emissions) has on the respiratory system (e.g., mortality and morbidity, hospital admissions, and lung function changes) (Chen, Hong, & Kan, 2004). Since 1997, sulfur dioxide (SO_2) emissions in Guangdong have risen by 87 percent and are higher than the national average ("Sulphur dioxide," 2006). (See Figure 2.) Likewise, incidences of respiratory-related ailments have also increased over time.

In 2006, Guangdong recorded its worst air pollution in decades despite continued government promises to address the problem. In 2006, the average number of smoggy days (e.g., visibility below 10 kilometers) reached 75 in Guangdong, a 20 percent increase over 2005 (Zhai, 2007). Major cities such as Guangzhou experienced even higher levels of smoggy days—120. Cars, power generation, and a new surge in heavy industry development by the provincial government in Pearl River Delta (PRD) have exacerbated smog and acid rain problems. The fact the provincial government continues to focus on heavy industry development within the PRD

basin rather than spreading it throughout the province has greatly intensified air pollution problems (Zhai, 2007).

Beyond air pollution, Guangdong must confront serious water pollution problems in its rivers and coastal areas. A recent water quality study by the Guangdong People's Political Consultative Conference (GPPCC) found higher pollution levels in 42 of 111 rivers than a year previously, with 28 percent of all rivers experiencing severe pollution. The severity of the pollution stems in great part from the fact that wastewater treatment occurs in less than 2 percent of Guangdong's cities and townships ("Guangdong pledges," 2006). Further, local news media reported a rapid deterioration in the Pearl River's water quality to a Grade V, the lowest grade, indicating water not even suitable for industrial use ("Guangdong pledges," 2006). In 2006, the *China Daily* revealed that slightly more than 40 percent (22 million) of Guangdong's rural population do not have access to safe drinking water. The provincial environmental protection bureau received about 80,000 pollution complaints in 2005, most of which were related to water pollution. To begin addressing the dire rural water problems the province has allocated 7.2 billion Yuan ($900 million) in the Eleventh Five-Year Program period (*China Daily*, 2006).

POLLUTION AND HEALTH LINKAGES IN GUANGDONG

Located within the Pearl River Delta (PRD) region, the twin economic engines—Guangdong and Hong Kong—face increasingly polluted soil, air, and water, with their cross-boundary exchange of pollution negatively impacting the region. Guangdong's massive industrial/manufacturing complex and the rapid increase in vehicles are degrading the air quality for Guangdong and Hong Kong. In 2004, exhaust emissions totaled over 1.7 million tons, which represents a significant share of total air pollution in the region (Jun, 2004).

Historical trends for lung cancer mortality rates in Guangdong show a significant increase from 28.54 to 39.58 per 100,000 in the 1976-1979 and 1990-1992 periods, respectively (Zhao, Wang, Aunan, Seip, & Hao, 2006). While these figures are slightly dated, they indicate the escalating trajectory of lung cancer cases in Guangdong Province.

Health-threatening pollution from water can be categorized as biological (e.g., microorganisms) or chemical (e.g., heavy metals, fertilizers, and oil). Infectious disease linked with water pollution remains a concern in Guangdong, particularly with regards to chronic diarrhea in children. Other water pollution-related chronic health problems, in particular digestive system cancers, represent a significant health burden in the province. A study conducted by the Population, Resource, and Environment Commission of the GPPCC determined more than 2.5 million people around Guangzhou face increased health risks from contaminated drinking water due to heavy pollution at five water treatment plants in the municipality ("Polluted water," 2007).

Processing of domestic and illegally imported electronic waste is also a major contaminant of Guangdong's water and soil. (*Editor's Note: See Commentary by Choi in this issue on the topic*). Continual exposure to various chemical pollutants in Guangdong's drinking and agricultural water has lead to "cancer villages" such as around Shangba in northern Guangdong, where one unconfirmed account indicates that nearly 250 out of 3,000 villagers have died of cancer since 1987 (Griffiths, 2007). Mines near the village, one owned by the Guangdong provincial government, have been releasing polluted water into local rivers, elevating the lead to 44 times the permitted level ("A great wall," 2004; Griffiths, 2007). Like the rest of China, violent rural protests over pollution are increasing in Guangdong.

Current Environment and Health Research

Environmental health research within Guangdong and the Pearl River Delta region has attempted to assess the exposure-response for varying air and water pollutants, as well as investigate soil, water, and air pollution. In-depth analytical research will, as expressed by a recent World Bank report on premature deaths related to environmental pollution in Guangdong, reduce the information gap and produce a more comprehensive understanding of the health and non-health consequences of pollution. The study focuses on the exposure-response relationship between drinking water contamination and health effects in Guangdong (World Bank & SEPA, 2007). Even though additional research must be conducted, organizations across Guangdong Province have investigated pollution sources, health outcomes, and the movement of air and water pollution. (See Table 2).

TABLE 2. Select Research on Environmental and Health Issues in Guangdong & Pearl River Delta

Research Institutions	Issue(s)	Area	Year
World Bank & SEPA	Economic costs of pollution	China, Guangdong	2007
Guangdong Institute of Ecology	Heavy metal contamination of agricultural product	Pearl River Delta region	2007
Guangzhou Institute of Respiratory Disease	Indoor air pollution and COPD	Guangdong	2007
University of Hong Kong & Civic-Exchange	Air pollution costs and potential solutions	Pearl River Delta region	2006
UCLA, Jiangsu Provincial CDC & Fudan University	Air pollution and case fatality of SARS	China, Guangdong	2003
Guangzhou Institute of Geochemistry & University of Macao	Persistent organic pollutants (POPs)	Pearl River Delta region	2003
Hong Kong Polytechnic University	Modeling cross-boundary water pollution transport	Pearl River Delta region	2003
Hong Kong Polytechnic University & Guangzhou Institute of Geochemistry	Heavy metal contamination of agricultural land	Pearl River Delta region	2001

Source: Compiled by authors.

THE VANGUARD FOR ENVIRONMENTAL HEALTH?

The Guangdong Phenomenon…

Guangdong is the richest province in China producing about 12 percent of the national GDP, higher than any other single province (Ruwitch, 2006) and its progressive economic policies and successes have made it the focus of much international scholarship and media attention. The province gained national economic prominence in 1980 when China's first Special Economic Zones were established (Guangdong PPC, 2004). Guangdong's economic significance was further elevated in 1992, when Deng Xiaoping visited it during his famous Southern Tour and called for renewed economic liberalization ("Deng's southern tour," 2007). Such doting on Guangdong from the central government contributed to its continual economic growth and has helped the province maintain an annual average GDP of over 10 percent since 1978 (Wing-Hung Lo & Tang, 2006; "FDI inflows," 2006). Measurements of Guangdong's economic development in 2005 and 2006 further illustrate its status as an economic powerhouse. As a percentage of the country's total, its foreign trade accounted for one-third; its foreign direct investment represented over one-fourth (DFTEC, 2006); and its GDP equaled nearly one-eighth (Yeung, 2007). These figures indicate how Guangdong has national, as well as international, economic stakeholders. Moreover, such economic achievements readily translate into enviable political status and prestige.

In what has become known as the "Guangdong Phenomenon" (*Guangdong Xianxiang*), the provincial government has established a reputation for being politically assertive, even in the environmental

sphere (Yang, 2004). For example, in response to international bans in the late 1990s on agricultural products from Guangdong for excessive pesticide residues, provincial leaders, in partnership with its agricultural universities began to reorient the province's food production system to promote development and certification of organic food. Guangdong became the leader of this small, but growing, organic food market in China (Riggs, 2005).

Moreover, some experts view Guangdong Province as separate from the country, maintaining an "awkward relationship with Beijing."[3] Somewhat politically insulated, Guangdong operates with a unique degree of autonomy, which can potentially lead to progressive as well as regressive polices. The Guangdong Provincial Peoples Congress (Guangdong PPC) involvement in the Sihui case that opened this paper represents an important example of the province's environmental progressiveness. This congressional move substantially altered the Guangdong PPC's de facto role as a "rubber-stamp" organization and pushed the envelope for further local government reform (Yang, 2004; Wang, 2005; Wang & Wang, 2006). A few months into the Sihui investigation, the Guangdong PPC adopted a new regulation, which now requires all major development programs within the province be submitted to the PPC for approval. While the regulation was adopted in conjunction with the Sihui case, it was actually in the making for five years and was previously rejected three times by the Guangdong PPC's Standing Committee ("Local People's Congress," 2000). Clearly, the political implications of this case extend beyond the realm of environmental protection; thus, it has attracted the attention of a diverse range of China watchers. Guangdong also has been a leader in promoting greater government openness and public participation through e-government and other such forums, which are now common across China's central and local levels (Yang, 2004).

…Or Just Phenomenal Pollution?

Guangdong's environmental health degradation provides both a challenge and an opportunity for its provincial leaders. A January 2007 update from the Consulate-General of Canada in Hong Kong assesses of the current dismal environmental situation in Guangdong:

According to statistics from Guangdong Provincial EPB, Guangdong's occurrence of environmental polluting incidents has intensified in the recent years, causing considerable instability to the society. In 2005, 32 polluting incidents broke out in Guangdong, of which the North River's cadmium contamination is the most serious environment incident ever recorded since the 50s. As the situation worsened, Guangdong plans to invest RMB 2.2 billion during the 11th five-year plan period to set up an environmental monitoring centre.

A counterbalance to the environmental deterioration is Guangdong's increasing commitment to invest in environmental pollution control and monitoring and to release environmental data from provincial and regional monitoring networks. In the Tenth Five-Year Program, Guangdong's investment in environmental monitoring capacity reached 700 million Yuan yielding a threefold increase in data collected on various environmental indices. With 22 environmental monitoring stations certified by SEPA's national laboratory, Guangdong ranks second after Jiangsu Province in the number of certified stations (Consulate-General of Canada, 2007). In terms of overall investment in environmental protection, in 2006 Guangdong invested more than 60 billion Yuan, which equals approximately 2.5 percent of the province's GDP—a ratio significantly higher than that of most other provinces (Zhan, 2007).

While pollution control and monitoring are crucial, the central challenge is whether Guangdong officials are willing to undertake aggressive measures to address some of the political factors and business investments that are driving the pollution. Most of Guangdong's growth has been fueled by low-tech, highly polluting industries that require cheap, unskilled labor. Today there are signs the province is in a transition to shift to high-tech and less-polluting industries and develop a bigger service sector (Ruwitch, 2006). One catalyst for this is the 2007 central government campaign to crack down on the top 1,000 energy intensive industries—particularly those in Guangdong—requiring them to make significant cuts in energy use and emissions (Greising, 2007).

Air pollution in many of Guangdong's cities has become so severe that some municipal governments are closing down or moving particularly dirty industries out of their city to clear the skies. For example, while previously welcoming of any and all industries, today the leadership in Foshan (located on the west bank of the Pearl River next to Guangzhou) claims they are rejecting highly polluting businesses, for the city's smog is the highest in the province, making it one of the most unlivable

places in Guangdong (Ruwitch, 2006). This trend could ultimately mean some of the dirtiest industries move further inland to Hunan or Sichuan, where the hunger for investment is great and willingness to impose environmental standards low. In 2007, the mayor of Shenzhen took a unique, albeit superficial, stance to curb air pollution by asking citizens in the bustling city bordering Hong Kong to stop buying cars (Greising, 2007). A more significant move to improve environmental quality in the city was when in the late 1990s the Shenzhen government created a water resources bureau, which brought key local agencies together to manage water quality and quantity problems better (Eng & Ma, 2006).

Despite these progressive efforts, continued environmental degradation threatens to undermine Guangdong's high-level economic growth and development. Two recent cases reveal the economic consequences of water pollution. First, the cadmium contamination of Beijing River from the Shaoguan Smelting Plant on 15 December 2005 resulted in direct and indirect economic losses amounting to 150 million Yuan ($18.75 million) (Liang, 2005). Second, the U.S. FDA restrictions in 2007 on certain seafood products are seriously impacting China's $35 billion aquaculture industry. Within Guangdong, companies such as the Xulong Eel Factory in Taishan city face restrictions due to shipments containing residues of banned antibiotics, which farmers must give their fish to keep them alive in the extremely dirty river and coastal waters. In May 2007, the Guangdong Provincial Oceanic and Fishery Administration reported that nearly 8.3 billion tons of sewage—most untreated—were emitted into Guangdong's coastal waters in 2006, which is 60 percent more than five years ago (Xinhua, 2007). Fish stocks in the province's coastal areas are highly damaged by the heavy metal emissions, which include lead, copper, and cadmium. Recent studies by the Chinese Academy of Sciences and Guangdong scientists have detected seafood products contaminated with pesticides, including DDT, from eleven coastal cities in the Pearl River Delta region (Barboza, 2007). Thus, bans on Guangdong's seafood will most likely continue. If contamination of its lucrative aquaculture inspires Guangdong to significantly reverse water degradation trends, akin to its actions on pesticide residues, it could become a major provincial leader.

Recent pledges by cities within the province to meet pollution reduction targets highlight emerging local government initiatives to address these concerns ("Local governments vow," 2007). As an indication of the province's progressiveness in pollution control, Guangdong is setting up an environmental monitoring and control station, serving five additional provinces in the region. ("Guangdong reaches," 2007).

Environmental Health Efforts in Guangdong Province

Local government officials have made implicit and explicit public statements on environmental health and its implications for economic growth. In a public address at the Third Session of the Tenth Guangdong PPC, provincial governor Huang Huahua, for example, reported that the government would pay more attention to ecological protection ("GD expects," 2005). In multiple public appearances, Huang reiterated air pollution is high on the government's agenda, although he did not explicitly link air pollution to health concerns ("HK, Guangdong aim," 2006).

The Guangdong EPB website, on the other hand, dedicates multiple pages to informing the public on environmental health issues in general and air pollution/respiratory health issues in particular (Guangdong EPB, 2005).[4] Another key area of information disclosure is the abundance of news media reports on environmental health in Guangdong. Admittedly, these reports vocalize mixed views on the efforts being made by local government actors. Some have favorably compared Guangdong's pollution reduction achievements to those at the national level, arguing that the province is poised to be a national leader in this area ("Guangdong reaches," 2007). Other articles, particularly those quoting local residents, present a more negative assessment of the provincial-level government's environmental performance. As a demonstration of the distrust some Guangdong residents have of the local EPB's air pollution index, one resident said, "the pollution should be quite serious because I had problems breathing as I walked home… how dare the TV news tell us the air quality was good" (Huang, 2006). Similarly, another Guangdong resident attacked a highly polluting state-owned tire factory saying, "we don't need GDP for blood." He further stated that the factory's profits are "nothing compared with the health of the citizens" (Wang, 2007). Similar concerns are fairly common throughout Guangdong and widely reported in the news. As such, they demonstrate residents are leveraging health issues in their criticism of major pollution offenders.

Mirroring some of the national trends, there is a growing collection of laws, regulations, and standards in Guangdong focusing on environmental protection and also considering the health implications of pollution. For example, the Guangdong Provincial Environmental Protection Ordinance, which came into effect on 1 January 2005, clearly states its intention "to protect and improve the living environment and the ecological environment, prevent pollution and other hazards, and *protect human health* [italics added]." While the Guangdong PPC is considering environmental health, it is not an implementing agency and the lack of interagency coordination, especially between the central and local offices of the Ministry of Health and SEPA represent a significant barrier to truly effective environmental health policies.[5]

SO_2 as a Catalyst for Interagency and Regional Cooperation

The Environmental Framework Plan for Guangdong (2006-2020) represents another legislative attempt to address environmental health as a sub-issue within a broader environmental context. By 2010, the plan aims to reduce SO_2 emissions by 7.5 percent from 2005 levels ("Sulphur dioxide," 2006). Although the prospect of achieving this ambitious reduction target is in question, the plan nevertheless demonstrates a strong concern with the adverse effects of SO_2. Among other things, the plan cites declining public health and potential economic loss as the main risks associated with SO_2 and other air pollutants (Guangdong PPC, 2006).

While the formal interaction between government officials, agencies, bureaus, ministries, congresses, and councils on environmental health issues seems limited in Guangdong, the informal interaction of these institutional actors appears to be growing. One prominent example is the ongoing cooperation between the Guangdong PPC and the Hong Kong PPC to address various types of pollution, including air pollution. In 2002, Guangdong and Hong Kong launched the Action Blue Skies Campaign to study air pollution and adopt measures to improve air quality in the Pearl River Delta Region (Huang, 2006). Cooperation on environmental protection is one of the main aspects that both Guangdong and Hong Kong will emphasize during the next five years. Significantly, their shared objective is to reduce SO_2 emissions by up to 40 percent of their 1997 levels by 2010 (Huang, 2006). This timeline obviously corresponds to the Environmental Framework Plan for Guangdong.

Within Guangdong, institutional cooperation is also occurring between 21 municipal governments, which signed SO_2 emission cap agreements with the provincial government.[6] According to Guangdong's vice-governor Xie Qinghua, the province intends to lower SO_2 emissions to 1.10 millions tons by 2010, which is 15 percent less than 2005. To this end, the municipal government officials will enforce stricter desulphurization standards of existing and developing coal and oil dependent industries ("Reducing pollution," 2006).

GUANGDONG-HONG KONG AND THE PEARL RIVER DELTA REGION COOPERATION

Neighboring economic powerhouses, Guangdong and Hong Kong, share environmental resources and negative pollution impacts on air and water. Both governments have acknowledged the shared responsibility for the Pearl River Delta region and strive to collaborate. A notable example is the establishment of the Joint Working Group on Sustainable Development and Environmental Protection (JWG), co-chaired by Hong Kong's Secretary for the Environment, Transport, and Works and Guangdong's Director of Environmental Protection. Formed in June 2000, the JWG provides structured cooperation on a wide range of environmental issues. In December 2005, the JWG held its sixth meeting to review progress on current initiatives and discuss future goals, with an emphasis on air and water pollution (HKEPD, 2006).

Air Quality Monitoring Network

Unique to China, the governments of Guangdong Province and Hong Kong SAR established a regional network to monitor air quality throughout the Pearl River Delta Region. (See Figure 3). Joint efforts by the Guangdong Environmental Protection Centre and the Hong Kong Environmental Protection Department from 2003 to 2005 yielded the Pearl River Delta Air Quality Monitoring Network (the Network). The Network has been reporting data from 16 automatic air quality monitoring stations throughout the PRD in the publicly accessible Regional Air Quality Index since 30 November 2005 (GPEMC & HKEPD, 2006).

Previously, incomplete or poor information on air quality characterized the region leading to an inability to assess the true extent of its air quality

FIGURE 3. Air Quality Monitoring Network

Source: Figure adopted from GPEMC & HKEPD (2006).

and formulate appropriate control policies. Thus, the three primary objectives of the Network are to: (1) provide accurate air quality data, (2) evaluate long-term effectiveness of pollution control policies, and (3) inform the public on regional air quality (GPEMC & HKEPD, 2006). Monitoring stations collect and measure four air pollutants, SO_2, NO_2, respirable suspended particulates, and O_3, and permit site-specific monthly and annual averages as well as daily and hourly maximum and minimum averages. In early 2007, Civic Exchange, a Hong Kong-based NGO, described the Network as a "major advance," which systematically accumulates data year after year. Assessments by Civic Exchange observed how on an annual basis, everyone within the area covered by the monitoring network is breathing air that is a danger to their health (Civic Exchange & Institute for Environment, 2006). Such research analysis may pave the way for bold strides in environmental health.

The first year of data collection in 2006 has helped inform trends and depict spatial distributions of the four pollutants and reveal seasonal variations. Daily reporting of the Regional Air Quality Index provides continuous information to the public on daily air quality at the 16 monitoring stations.[7]

As seen in Table 3, air quality grades show significant variation across the Pearl River Delta as well as within districts in two of the most polluting municipalities in Guangdong (Guangzhou and Foshan) and in Hong Kong.

Particular concern should center on districts reporting air quality Grades IV or V, which indicates that China's Class 2 National Ambient Air Quality Standards (NAAQS) have been significantly exceeded for the pollutants. Disaggregated air quality data reveals environmental pollution hotspots and underscores the need to combine Guangdong Province or the PRD region into a single data point hides major trouble spots. Foshan municipality represents one area of concern for provincial and regional officials, since during approximately a third of 2006, its air quality declined to Grades IV or V.

Thus, the Guangdong and Hong Kong governments must prioritize must prioritize extensive data collection across the region, continued investment and expansion of the Network down to the county level and increasing the number of monitored pollutants in order to develop appropriate pollution control policies.[8]

The central government and Guangdong Province investment into the PRD air monitoring projects totals 300 million Yuan ($38.4 million). Li Qing, Director of the Guangdong Environmental Protection Department (EPD), claims that "[the network] has so far been the nation's largest investment in an environmental project." Furthermore, Li believes "this endeavor, which is the nation's largest scientific and research project in terms of regional air pollution control, will…help improve air quality in the Pearl River Delta" ("China to create," 2007). Expansion of monitoring stations and improving the detection of multiple sources of air pollutants and continued release of collected data should help inform policymakers and provide the public with accurate air quality information for the region. In addition to these efforts, the JWG also is making plans to increase its efforts to combat air pollution through the introduction of an emissions trading scheme for thermal power plants in the Pearl River Delta region (HKEPD, 2006).

Water Quality Monitoring

Initial regional efforts to monitor and assess air quality proved to be highly successful in informing governments and the public on regional air pollution. Yet, equivalent efforts to monitor and assess water quality, another serious cross-boundary problem, have not accomplished a similar regional water quality monitoring network. Guangdong supplies nearly 80 percent of Hong Kong's water needs, with the primary source being the Dong River. Since 1989, a cross-border agreement stipulated

TABLE 3. Regional Air Quality Index Grade for Selected Districts in Guangzhou, Foshan, & Hong Kong, 2006

District	Grade I	Grade II	Grade III	Grade IV	Grade V
Guangzhou	16.33	42.86	34.4	4.96	1.46
Guangzhou	17.28	31.44	33.71	13.6	3.97
Guangzhou	35.5	47.34	14.2	2.96	0
Foshan	5.62	34.32	31.95	18.34	9.76
Foshan	0.92	32.62	32.31	18.77	15.38
Hong Kong	29.19	55.2	14.16	1.16	0.29
Hong Kong	39.48	55.33	4.61	0.58	0
Hong Kong	31.18	46.76	19.71	2.06	0.29

Note: Grade I represents high quality air and Grades IV and V signify extremely unhealthy air.
Source: GPEMC & HKEPD (2006).

that Guangdong Province must ensure water quality standards for raw water supplied to Hong Kong. In an event of poor water quality, the Hong Kong Water Safety Department will liaise with authorities in Guangdong to rectify poor water quality (Hong Kong WSD, 2000).

Water quality in the PRD region remains a concern with the Joint Working Group, which has placed several water quality control measures on the agenda. In 2006, several ongoing activities address various water pollution issues include development of a water quality model for the Pearl River Estuary. Similar to the Network monitoring air quality, the water quality model will be used as an analytical tool to inform and support appropriate measures to control water pollution, such as conducting a needs assessment of water pollution in Shenzhen Bay and analyzing strategies for protecting the quality of Dong River's water (HKETO, 2006; HKEPD, 2006). Both Guangdong and Hong Kong officials must confront lax enforcement of environmental standards and government officials' complicity in the release of untreated industrial and public waste water throughout Guangdong.

CAUTIOUS OPTIMISM

Discussions of China's environmental health situation must not portray it as a homogeneous picture, for significant regional disparities exist in China. For example, the coal-producing regions of northern China (centered on Shaanxi) are poor and even more polluted than the PRD. In stark contrast Guangdong, while highly polluted, is a wealthy, politically powerful province, which has a unique partnership with Hong Kong to help accelerate its research and policy development in the pollution prevention and environmental health spheres. While Beijing remains weak in enforcing environmental laws, continued prioritization at the central level of environmental problems threatening human health will play an important role in helping progressive forces in Guangdong and other regions clean up their air and water.

While it is perhaps too soon to claim that Guangdong is China's vanguard for environmental health, there is reason to continue following developments in the area with optimism. The success of the Regional Air Quality Monitoring Network and other similar initiatives will require continued provincial government support and a commitment for transparency—two issues which are by no means certain in China. Nonetheless, these initiatives represent a decisive step forward for Guangdong, the PRD, and China in general. Additional research on local progress in light of national developments will be needed to continue filling gaps in existing scholarship on this topic.

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NOTES

1. The figures are approximately 511.8 billion Yuan for total cost and 219.8 billion Yuan for air pollution-related costs.

2. For more information on this forum see: http://www.rrcap.unep.org/envhealth/index.cfm.

3. Authors interview with Drew Thompson, June 28, 2007.

4. This information ranges from explaining air pollution terminology such as total suspended particulates to identifying its negative health impact on the respiratory system. The website also provides information on the health risks associated with sulfur dioxide, which is the largest component of Guangdong's industrial emissions ("Sulphur dioxide," 2006).

5. Authors interview with Drew Thompson, June 28, 2007.

6. The agreement also considered chemical oxygen demand (COD), but given the focus of this paper, we have omitted it from our discussion of institutional coordination.

7. For additional information on the Regional Air Quality Index public website, please see http://61.144.36.8/equality2/raqi/eng.aspx.

8. Authors interview with Drew Thompson, June 28, 2007.