



# Water Quality and Environmental Health in Southern China

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Laura Ediger, Environmental Manager

Linda Hwang, Environmental Research & Innovation

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## About this Report

This report is a summary of the first of two forums hosted by BSR to discuss the links between human health, water quality, and ecosystem health in China, and identify roles and responsibilities among invited stakeholders. In June 2008, BSR received funding from the Rockefeller Brothers Fund to initiate a two-year project focusing on water quality and environmental health in southern China. This first forum was held on May 15, 2009, in Guangzhou and was attended by nearly 60 registrants representing business, civil society, government, and public health.

Please direct comments or questions to Laura Ediger at [lediger@bsr.org](mailto:lediger@bsr.org).

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A leader in corporate responsibility since 1992, BSR works with its global network of more than 250 member companies to develop sustainable business strategies and solutions through consulting, research, and cross-sector collaboration. With six offices in Asia, Europe, and North America, BSR uses its expertise in the environment, human rights, economic development, and governance and accountability to guide global companies toward creating a just and sustainable world. Visit [www.bsr.org](http://www.bsr.org) for more information.

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## Introduction

The Pearl River Delta in southern China combines abundant freshwater resources and high population density with one of the most intensive export manufacturing zones in the world. The rapid development of the area over the last 20 years has created a similar boom in water pollution discharge, which provincial environmental protection officials have been scrambling to contain.



Increasingly stringent water protection regulations and pollution discharge standards have set a high bar for companies operating in the region, but environmental protection officials have struggled to effectively enforce them.

The reliance of a large population on these polluted water resources has significant implications for public health and the risk of both infectious and chronic diseases. Health officials are focused on the immediate need for providing safe drinking water to the millions of rural residents who either cannot access it or who cannot afford it, but the contaminated water being used for human consumption, industry, and agriculture also has a number of less-visible effects.

Even as official data show that the water quality in the region has improved, a number of challenges remain. Despite steady investment in treatment plants, the current infrastructure used to treat municipal wastewater is insufficient, and 50 percent of sewage is left untreated. Meanwhile, the local economy is still heavily dependent on certain highly polluting industries, and in the face of slowed economic growth, there have been reports that enforcement of environmental standards for industrial wastewater has eased. As China attempts to balance the demands for economic stimulus against the need for environmental protection, how much progress is made in the ongoing struggle to clean up the country's polluted waterways will be a key indicator of success.

## Water Quality for Ecosystem and Human Health

There are many challenges to effectively controlling water pollution for improved human health:

- » Water pollution in China has been linked to increased chronic and infectious disease, causing negative social and economic impacts.
- » Governments, businesses, and civil society want a sustainable clean water supply that enables economic growth and social development.
- » Businesses and consumers lack sufficient and reliable data, government enforcement of regulations is limited, and incentives for improving water quality are flawed.
- » The private sector and civil society have an opportunity to support enforcement and awareness by means of communications and training, and through creative project design and implementation.

## Water Quality and Health

### Sources of Water Pollution

Along with air pollution, the high levels of water pollution resulting from intensive industrial development in parts of southern China are raising increasing concerns about public health impacts in the densely populated region. Although some of the most egregious pollution sources have been reduced or eliminated, often due to the relocation of manufacturing operations to less-developed parts of China,<sup>1</sup> a core group of high-polluting industries remain a cause of concern. In a recent monitoring project, the Guangdong Environmental Protection Bureau (EPB) targeted electroplating, textile dyeing, chemical production, tanneries, and poultry farms as some of the industries producing the highest levels of pollutants.<sup>2</sup>

Challenges remain, as corruption is widespread and government officials often prioritize the interests of the local economy over the local environment. However, provincial and national level oversight and enforcement has helped to bring gradual progress on industrial pollution. Guangdong's position as a relatively well-off province, accounting for around one-third of foreign trade and one-eighth of China's GDP, endows it with the resources to invest in upgrading enforcement capacity and the luxury of being selective regarding its industrial base.

Although heavy metals and toxic organic chemicals are a continued concern, contamination sources are increasingly shifting to non-point-source pollution such as runoff from agricultural production. The average level of fertilizer use in Guangdong is nearly 600 kilograms per hectare (kg/ha), far higher than the 225 kg/ha that is the limit set in some developed countries.<sup>3</sup> In addition to the excess fertilizers and pesticides that flow into rivers and seep into groundwater, untreated domestic sewage contributes to high nutrient levels and eutrophication, a state of excessive plant growth that reduces dissolved oxygen in water. Not only is this state of low oxygen harmful to aquatic ecosystems, it also can directly impact human health by causing the production of toxins that promote liver cancer.<sup>4</sup>

Even as there are slow improvements in industrial wastewater treatment, the infrastructure for treatment of domestic sewage is inadequate in both geographical coverage and capacity. As of 2007, Guangdong was treating only 50 percent of the province's domestic sewage<sup>5</sup>, and 45 medium-sized cities were completely lacking any wastewater treatment facilities.<sup>6</sup> By mid-2009, there were a total of 175 wastewater treatment plants in operation, and the government is continuing to build additional facilities in a bid to keep pace with escalating demand.<sup>7</sup>

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1 "Guangdong pollution levels fall." People's Daily Online, February 12, 2009. Available at <http://english.people.com.cn/90001/6590745.html>.

2 "Guangdong checks high-polluting industries in 'Two Rivers' area." China Environment News, June 17, 2009. Available at [www.csid.com.cn/NewsInfo.asp?NewsId=107315](http://www.csid.com.cn/NewsInfo.asp?NewsId=107315).

3 Guangdong Environmental Science Research Institute presentation, BSR Forum on Water Quality and Environmental Health in Southern China, May 15, 2009, Guangzhou.

4 Ibid.

5 "Guangdong has completed construction of 160 wastewater treatment plants." Xinhua, December 23, 2008. Available at [http://shui.shejis.com/zxzx/xygc/200812/article\\_11710.html](http://shui.shejis.com/zxzx/xygc/200812/article_11710.html).

6 "45 cities in Guangdong have 0% wastewater treatment." Information Times, October 14, 2008. Available at [http://shui.shejis.com/zxzx/hyxw/200810/article\\_10143.html](http://shui.shejis.com/zxzx/hyxw/200810/article_10143.html).

7 "To strengthen pollution reduction efforts, Guangdong seeks an outlet for wastewater treatment sludge." Guangdong Environmental Protection Bureau, June 4, 2009. Available at [www.gdepb.gov.cn/tpxw/200906/t20090604\\_62604.html](http://www.gdepb.gov.cn/tpxw/200906/t20090604_62604.html).

## Regulatory Environment

The physical challenge of building sufficient infrastructure is immense, as is the regulatory effort to protect water bodies, limit pollutant discharge, and monitor drinking water quality and public health impacts. As in many other countries, regulation of these intersecting issues in China is confounded by the complicated division of responsibility among many different agencies (Table 1). For example, while the Ministry of Environmental Protection has the mandate to protect surface water bodies and can issue pollution permits, the Ministry of Construction manages municipal wastewater treatment, and the Ministry of Health sets drinking water standards. Thus, the multiple flows into and out of a single river system are managed by a number of competing interests.

### Patchwork of Government Agencies Related to Water

Each of the relevant ministries has its own particular focus and initiatives related to water quality and public health. These range from an emphasis on protecting rural drinking water sources to ensuring that water-use fees are set at the appropriate level so that irrigation water is affordable but provides incentives against waste.

Table 1. Roles and Responsibilities for Water Management

Government Ministry	Responsibilities
Ministry of Water Resources	<ul style="list-style-type: none"><li>» Sets overall water resource development plans and policies.</li><li>» Implements large-scale distribution of water resources.</li><li>» Sets water-extraction permitting and fees.</li><li>» Regulates water industry.</li><li>» Sets water-conservation goals.</li></ul>
Ministry of Environmental Protection	<ul style="list-style-type: none"><li>» Sets water-quality standards.</li><li>» Issues and enforces pollution-discharge permits.</li><li>» Monitors water bodies.</li><li>» Protects drinking water sources.</li></ul>
Ministry of Construction	<ul style="list-style-type: none"><li>» Manages sewage treatment and water transport.</li><li>» Builds and operates municipal wastewater treatment plants.</li></ul>
Ministry of Health	<ul style="list-style-type: none"><li>» Manages public health impacts of water quality.</li><li>» Sets drinking water standards.</li><li>» Monitors drinking water quality.</li></ul>
Ministry of Land Resources	<ul style="list-style-type: none"><li>» Oversees and monitors groundwater resources.</li></ul>

## Water-Quality Status

The most recent report from the provincial EPB found that nearly 70 percent of the 116 river sections that were tested in Guangdong met the water-quality standards for Grade II-III, designating them clean enough for human consumption and recreation.<sup>8</sup> Around 10

<sup>8</sup> Guangdong Environmental Protection Bureau, 2009. Guangdong Environmental Status Report 2008. Available at [www.gdepb.gov.cn](http://www.gdepb.gov.cn).

percent of these rivers still had water so polluted that it was not suitable for any use. This marks a slight improvement from previous years.

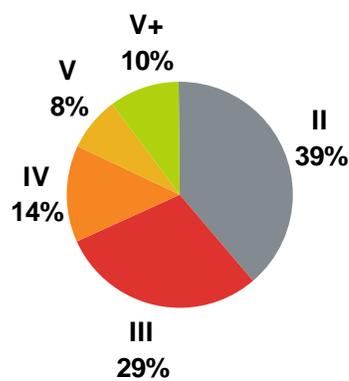
The 2008 “National Environmental Status Report” stated that the Pearl River overall has good water quality, although in the area near Guangzhou, the provincial capital, it is labeled as Class IV, and therefore not suitable for human consumption or recreation. In general, the water quality becomes rapidly worse as it flows from the interior toward the industrialized coastland. The Shenzhen River, near the border with Hong Kong, is rated Class V+, as it is extremely polluted and unsuitable for any use.<sup>9</sup> However, the macro-view of water quality and the classification of particular river segments into a single category may mask localized high levels of pollutant discharge.

## Water Quality Classifications

- » Grade I: water sources and national nature preserves
- » Grade II: Level I protected area for drinking water supply, suitable habitat for rare species of fish
- » Grade III: Level II protected area for drinking water supply, suitable habitat for common species of fish, and swimming zones
- » Grade IV: industrial water supply and suitable for recreation in which there is no direct human contact with the water
- » Grade V: agricultural water supply
- » Grade V+: extremely polluted, unsuitable for any use

## Chart 1. Guangdong Water Quality (2008)

A 2005 national survey of organic pollutants in five urban areas in Guangdong found that despite a high total load and level of different pollutants, the levels complied with national standards for surface water. Another survey in 2007 found that while designated drinking water sources were within regulatory limits, other river segments were seriously polluted with organochlorines, heavy metals, and other organic solvents.<sup>10</sup>



Source: Guangdong Environmental Protection Bureau. 2009. Guangdong Environmental Status Report 2008. Available at [www.gdepb.gov.cn](http://www.gdepb.gov.cn).

## Impacts on Human Health

The most direct impact of water pollution on human health comes through drinking contaminated water, but contaminants can be absorbed through the skin and ingested from food as well. Both biological pollutants (micro-organisms) and chemical pollutants (nitrates, phosphates, heavy metals, organic compounds, and oil) can have immediate effects as well as long-term health implications. Previous studies of the health impacts of water pollution in China have found evidence of increased rates of liver and stomach cancer due to the consumption of water with high levels of chemical oxygen demand (COD) and heavy metals.<sup>11</sup>

There are limited studies that actually quantify the public health impacts of drinking polluted water in China, and in the Pearl River Delta specifically. This is partly due to a lack of sufficient data on exposure, as well as the difficulty of establishing exactly which sources of exposure are causing disease. Except in the case of “cancer villages,” where extremely high levels of local pollution have caused massive incidence of cancer in local

<sup>9</sup> National Environmental Status Report 2008.

<sup>10</sup> Guangdong Environmental Science Research Institute, presentation at BSR Forum on Water Quality and Environmental Health, May 15, 2009, Guangzhou.

<sup>11</sup> World Bank and SEPA, 2007. Cost of Pollution in China: Economic Estimates of Physical Damages. The World Bank Group.

populations, the precise impacts of consuming or being exposed to polluted water are difficult to detect.

More indirect exposure, from skin contact or from eating fish or even vegetables that were irrigated with polluted water, is even harder to trace. However, the pervasive nature of water pollution and related contamination of groundwater and soil means that the pollutant residues are persistent, and the potential sources of exposure are many.

## Collaborative Strategies

There are numerous examples of how businesses today are engaging in partnerships to help maintain water resources over time. Some examples include:

- » Water Footprint Network:  
[www.waterfootprint.org](http://www.waterfootprint.org)
- » Alliance for Water Stewardship:  
[www.allianceforwaterstewardship.org](http://www.allianceforwaterstewardship.org)
- » Beverage Industry Environmental Roundtable:  
<http://bieroundtable.com>
- » BSR's Sustainable Water Group:  
[www.bsr.org/consulting/working-groups/sustainable-water.cfm](http://www.bsr.org/consulting/working-groups/sustainable-water.cfm)

## Business and Water Management

As noted previously, industrial activity can adversely affect water quality and subsequently pose significant risk to freshwater resources. Industrial operations can alter hydrological characteristics of entire regions, affecting surface runoff, soil moisture, evapotranspiration, and groundwater behavior. Businesses that fail to responsibly manage impacts to water resources (both surface and groundwater) on both a local and regional scale will find it increasingly difficult to obtain community and government support for existing and future projects. As a result, sound water-management practices to prevent or minimize water pollution are fundamental for industrial operations to be sustainable and maintain their social license to operate.

Water therefore needs to be regarded as a vital business resource, requiring appropriate planning and accountabilities. A stewardship approach can deliver high standards in water management and a commitment to continuous improvement. Stewardship requires a long-term perspective and considers production, community concerns, technology, research, and public policy issues as an entire system.

### Effective Wastewater Management

The mishandling of industrial waste and chemicals impacts local communities but also has the potential to affect downstream communities that are connected by surface water or groundwater systems. For example, the 2005 chemical spill into China's Songhua River<sup>12</sup> in the northeastern region of the country forced the evacuation of thousands of people, poisoned the water supply for millions of people in the region's major city, Harbin, and threatened the supply for as many as 70 downstream cities and villages in Russia. Perhaps more alarming, the spill involved 100 tons of benzene, a powerful carcinogenic petrochemical that has been linked to leukemia.

Wastewater management presents an opportunity for companies operating in southern China to ensure the protection of surrounding ecosystems and human health. Many global companies operating in the region have worked with local manufacturing facilities to develop wastewater-monitoring and wastewater-treatment programs. Some companies also introduce established and emerging sustainability practices into their supply chains, actively encouraging and facilitating suppliers in conducting assessments and improvement of water usage and impacts.

### From Shared Risks to Shared Benefits

Ultimately, water-related risk mitigation and social, economic, and environmental stability can be achieved only through well-managed water resources. Achieving responsible water management through alignment of corporate and public interests can result in "shared benefits" for all stakeholders, including government, civil society, and the private sector, all of whom desire sustainable and reliable water supply that enables equitable and long-term economic growth without destroying the ecological systems that support life.

Because water is a shared resource, companies can rarely achieve the best water-management outcomes on their own. Most solutions to water supply, quality, and sanitation issues require an adaptive co-management approach. Yet while there is increasing momentum around water-conservation and quality-improvement activities, there is little discussion on how companies can manage water-related risk through organizational alignment of their corporate water strategies with public policy goals and multistakeholder initiatives.

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<sup>12</sup> "Effects of China's Songhua River chemical spill still emerging." Environment News Service, January 13, 2006. Available at [www.ens-newswire.com/ens/jan2006/2006-01-13-05.asp](http://www.ens-newswire.com/ens/jan2006/2006-01-13-05.asp).

# Water and Environmental Health Project in Southern China

## Project Objective and Main Activities

In response to the growing recognition that businesses can and should play a larger role in achieving water-related policy goals, as well as increasing expectations by society for businesses to transparently participate in regional and international water-governance efforts, BSR launched the China Water Quality Initiative to leverage our unique position in global supply chains. As part of this effort, in June 2008 BSR received funding from the Rockefeller Brothers Fund to initiate a two-year project focusing on water quality and environmental health in southern China. This funding allows us to raise awareness of the relationship between human health, water quality, and ecosystem health and function, as well as build strategic partnerships among businesses, local government, the scientific community, and environmental protection organizations.

The Pearl River Delta region is rich in natural resources and biodiversity. However, population growth, industrialization, and urbanization in the region during the past two decades have contributed to the degradation of the region's ecosystems and environment.



In particular, this funding allows us to carry out and implement the following activities:

- » Build capacity for responsible water management in apparel factories in Guangdong province.
- » Develop water-management curriculum for distribution through BSR's China Training Institute ([www.ctichina.org](http://www.ctichina.org)).
- » Develop peer health education programs for factory workers to build awareness of environmental health issues.
- » Host annual capacity-building forums on water quality and environmental health to disseminate findings and identify roles and responsibilities among stakeholders.

The first of two forums was held on May 15, 2009, in Guangzhou and was attended by nearly 60 registrants representing business, civil society, government, and public health. The unique, non-promotional learning environment was designed to help stakeholder communities understand the impact of poor water quality on human health and ecosystem function, in order to develop solutions for responsible water management.



## Wastewater Management in China

China's current national Five-Year Plan (2006-2011), calls for a departure from the "old, growth-at-any-cost model that has led to many rivers being polluted." This shift will require massive investment in water-quality treatment systems. Northern China, for example, plans to spend more than US\$100 billion to address the issues in its ongoing five-year plan.

Source: "38b tons of waste water flows into major rivers." Xinhua News Agency, December 20, 2006.

# BSR Forum: Water Quality and Environmental Health

## Overview of Speakers and Topics

Speakers from local and national government agencies, businesses, and civil society groups each shared their unique insights into water-quality and environmental health issues, as well as the specific approaches that each sector is taking. Government representatives from the Guangdong Environmental Science Research Institute and the Center for Disease Control discussed government initiatives to protect drinking water and limit water pollution, and also described the main impacts of water pollution on public health at a national and provincial level. BSR presented information on environmental health and possible solutions for addressing water-quality management through a collaborative approach.

Two case studies of the corporate approach to water-resource management were then presented: Sean Cady from Levi Strauss & Co. described Levi's lifecycle assessment to understand the environmental impacts of one pair of denim jeans, and Dr. Yu Jianming from Fountain Set explained his research on how to reduce water usage by altering the polarity of cotton fabric.

The afternoon session highlighted three different civil society projects that are tackling environmental health issues and water pollution. These projects were presented by Huai He River Defenders, South China Nature Society, and Jinan University Students in Free Enterprise.

## Challenges

Participants identified three main types of challenges to effective control of water pollution and improvement of human health. These include a lack of sufficient and reliable information for businesses and consumers, limitations to current government enforcement of existing regulations, and flawed incentives for improving water quality.

### INFORMATION

There is limited availability of relevant China-specific data and studies that demonstrate the link between water pollutants and human health. In-depth epidemiological studies would help prioritize and identify particular pollutants and their impacts, and convey the importance of water quality to the public. Meanwhile, the lack of effective communication about environmental protection and water-quality concerns contributes to a low level of consumer awareness. Both consumers and companies have yet to fully accept the physical risks related to the supply of clean water, which would lead to more responsible management.

### ENFORCEMENT

Water regulations in China are generally comparable to international standards, and the responsibility for enforcement is delegated to local environmental protection bureaus. While regulations are relatively stringent, the challenge is related to effective enforcement. Local governments often suffer from a conflict of interest, as they want to support local businesses and economic development, resulting in unclear signals as they strive to support both economic development and environmental protection. This creates a lack of public confidence in the capacity of government bodies to effectively protect water quality and enforce pollution regulations. The role of government agencies in protecting public health is also limited by the fact that no agency is held directly accountable for public health outcomes.

### INCENTIVES

The low price of water and pollution permits, as well as the low cost of penalties for violating water-pollution standards, fails to create appropriate incentives for water users and polluters to modify behavior. The inclusion of externalities into existing fee structures would encourage users to improve efficiency and limit or eliminate pollutants. Partly for

these reasons, there is often no clear financial return for improving water quality. Water-treatment facilities are relatively expensive to build and operate, and the cost often cannot be justified on a strictly financial basis.

Huai He River Defenders Director Huo Daishan (left) presents the history, challenges, and impacts of his organization's Lotus Model. Forum attendees (right) participate in an afternoon breakout session.



## Solutions

The solutions discussed during the afternoon session focused on three main approaches: communication and training, research and design, and monitoring of existing water-quality or water-management practices.

### COMMUNICATION AND TRAINING

- » Network among organizations to share best practices on water management and remediation of health impacts.
- » Research and publish industry-specific case studies, with a focus on the food, apparel, and electronics industries.
- » Create training and networking courses to provide expertise on water management and health issues in a “train-the-trainer” format.
- » Create consumer-oriented campaigns to increase awareness.
- » Increase interaction among businesses and student groups, including factory tours.

### RESEARCH AND DESIGN

- » Enhance cooperation between BSR and Chinese industrial associations to study and work on water issues, to effectively reach specific industries and a large number of companies.
- » Research improved treatment options for water pollutants, especially heavy metals.
- » Introduce product innovations to reduce the amount of pollution discharge and improve water quality.
- » Apply specific technologies, such as the “cation method” for cotton dyeing, which reduces the amount of dye used and discharged.

### PROJECT IMPLEMENTATION

- » Create a joint water assessment by local residents, companies, and local government.
- » Collaborate with schools to protect and monitor water quality in the local watershed.

- » Support student groups to survey and collect information on local perceptions of water quality and health impacts.
- » Gather information from suppliers on water volume, wastewater recycling, and discharge, and then work with suppliers to help with water-management solutions.
- » Support increased transparency and environmental information disclosure.

## Next Steps

It is vital that stakeholders work together to contribute to the development of approaches that will help value water in a sustainable way, leading to improved social and human health outcomes. The forum held in Guangzhou was a first step on a longer path toward an integrated approach to the management of water resources in southern China. BSR already has begun to use the information we heard from the participants to shape ongoing and future projects, and we continue to seek and promote innovative ideas that link water resources to ecological and human health outcomes.

A second forum, in 2010, will report on the work that we and our partners have begun during this year, and will invite a collective review of progress to date and perspectives on specific ongoing challenges. We will share from our own experiences, but also expect that businesses and civil society groups will have their own successes and lessons to share, to enrich the debate over how to effectively work toward sustainable water management, drawing on the unique resources and varied perspectives of different stakeholders. We look forward to continuing this dialogue, as one important piece of building a platform for ongoing discussion, innovation, and change.