

Hong Kong's Environment – From Pollution Control to Sustainability

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Introduction

In the latter part of the twentieth century, Hong Kong experienced explosive economic growth that came with an environmental price that the Hong Kong of the twenty-first century must now address. The market-driven, regulation-free approach that drove the entrepot's early economic development left the environment unprotected, but the economic boom of recent years has catalyzed the shift to environmental awareness. Brown skies and pungent water choked Hong Kongers who wanted a higher quality of life to accompany the newly found wealth that the economic boom generated. As reporter Chandran Nair comments, "An increasingly well educated and internationally aware population is beginning to demand improvements in the environment in areas such as air quality, noise, waste and marine pollution." (Nair, p. 1)

The establishment of the Environmental Protection Department (EPD) in 1986 ended the laissez-faire environmental policy, and with it began the regulation of the environmental effects of economic activity. Although the EPD spent the remainder of the twentieth century enacting stopgap measures to remediate the pollution of the city in the near term, the goals of the EPD have now begun to change to a long-range paradigm. The department is becoming less focused on near-term solutions to the "end of the pipe" effects of pollution on the environment and is beginning to concentrate on planning for continued growth and removing the causes of pollution. This planning for a sustainable city capable of continued growth has many fronts, from addressing the effects of

pollution, to efficient and clean energy, to stemming the flow of waste resulting from the economic boom of Guangdong Province on the mainland.

In this article I will examine what the EPD has done, what the current environmental situation in Hong Kong is, and what environmental challenges Hong Kong will face in the future. The EPD has been successful in addressing some effects of pollution and cleaning the Hong Kong environment. Recently, the department has shifted its focus to address some causes of the environmental damage in Hong Kong instead of focusing on cleaning up the damage from pollution; however, with the start of the new century, the department and the government as a whole must address sustainable development. Hong Kong has only 1,000 square kilometers of land area and one of the highest population densities in the world, making planning for the future of prime importance.

Past and Present Environmental Conditions

Hong Kong is a polluted city. Air quality is noticeably poor when one exits the new airport, odors emanate from the harbor and bay, and until recently some public beaches were totally unusable. As Kevin Bishop, reporting on the condition of Hong Kong's waterfront, puts it:

Having treated themselves to a hotel room with a harbour view, they [tourists] will perhaps want to take an early morning stroll along the waterfront and enjoy the sea air, or maybe look for a nice restaurant for an alfresco lunch or dinner by the water. ... They will, of course, be sadly disappointed. ... Not just disappointed to find the harbour distinctly lacking in junks, but disappointed that wherever they are able to gain

access to the waterfront – which can sometimes be a challenge in itself – they find an ugly bleak, hostile and unwelcoming environment. ... Few people ... take advantage of the alfresco option at ... Wanchai – the water lapping below the wharf stinks. (p. 2)

Bishop employs the *tabula rasa*, or clean slate, paradigm of the tourist to achieve a simple observation of the general environmental condition of the Hong Kong ecosystem. Bishop's observation is not scientific but clearly demonstrates the seriousness of pollution in Hong Kong to the typical tourist or layman.

In the next section I examine the current environmental situation in Hong Kong. In particular, I present data on air quality and water quality, and also discuss general environmental concerns as well as the environmental awareness of the Hong Kong population.

Air Quality

Air quality is a serious concern in Hong Kong. To address this problem, the EPD has established Air Quality Objectives, which have resulted in regular monitoring of air quality at both the street level and in the ambient atmosphere. During the last two decades of the twentieth century, the quality of air in Hong Kong has deteriorated; areas such as Central, Causeway Bay and Mongkok have exhibited the greatest decline.

Hong Kong classifies air pollution as street level, ambient and regional. (Hong Kong Policy Research Institute) Street level air quality poses the greatest health threat to the population, as this is the air being breathed and is also the most polluted. The air pollution on the street is primarily blamed on diesel vehicles, which account for about 70 percent of total vehicle mileage in Hong Kong. Additionally, during the period from

1991 to 1997, total annual vehicle mileage increased 25.2 percent. The increased mileage traveled by vehicles in Hong Kong will continue to contribute to the poor street-level air quality because tall buildings in the busiest sectors prevent the wind from clearing the air. (Hong Kong Policy Research Institute) In 2000 Hong Kong's three roadside air-monitoring stations all reported nitrogen dioxide and respirable suspended particulates (RSP) in excess of the Air Quality Objective (AQO); and Mongkok, a busy shopping district, reported total suspended particulates (TSP) in excess of the AQO. (Air Services Group, p. 3)

Ambient air, which is the high altitude air mass that blankets the city, is also a problem for Hong Kong, but less so than street-level air. Pollution levels in the atmosphere above Hong Kong are lower than on the streets, and the primary pollution sources are different. Ambient pollution is usually due to gases emitted from factory smoke stacks produced during industrial combustion and waste incineration as well as from vehicle emissions, although the impact of vehicle emissions on air quality is greater at street level. Power plants and heavy industry are the most likely sources of this type of air pollution. Pollution due to power generation increases with population, and pollution due to heavy industry increases with economic growth; therefore, ambient pollution has been on the rise as the population and economy have grown. (Hong Kong Policy Research Institute) However, Hong Kong's shift from heavy to light and medium industry in the last decade of the twentieth century has helped to slow the increase in air pollution as lighter industries produce fewer polluting stack gases. In 2000, all Air Quality Monitoring Stations monitoring the ambient atmosphere reported results within the AQO for nitrogen dioxide. However, Yuen Long district did not meet the AQO for

RSP and Kwai Chung, Sham Shui Po and Yuen Long did not meet the AQO for TSP.
(Air Services Group, p. 3)

The data for both ambient and street level air pollution tell two stories. The ambient air data indicate that the general atmosphere over Hong Kong is relatively clean, with some polluted areas. However, air quality of the breathable ground level atmosphere is poorer as shown by the street level monitoring stations. In other words, the air that blankets the city is relatively clean, but the air that one breathes is not.

Regional pollution effects from Guangdong and the surrounding areas have not been quantified to date, but they have been identified as impacting air quality in Hong Kong. Depending on the season, the trade winds can clear the city of air pollution, blowing the polluted air onto the mainland. However, trade winds can also have the opposite effect, bringing pollution into the city from the mainland. In any case, the rapid industrial growth of Guangdong has increased the impact of the trade winds on Hong Kong's air quality as more pollutants are blown in from the mainland. Certainly, the future expansion of industry in Guangdong will be an important environmental issue for Hong Kong.

Water Quality

Polluted water can impact humans through both direct interactions, such as drinking water and bathing, and indirectly via the food chain. Seafood is a large part of the Hong Kong diet. In 1998 nine beaches were listed in poor condition with 32 listed in acceptable condition (Hong Kong Policy Research Institute); and in 2000 six beaches were in poor condition, with 35 beaches receiving passing marks. (Environmental

Protection Department, p. 5) This trend indicates that the quality of beaches in Hong Kong may be improving somewhat.

A major source of heavy water pollution in Hong Kong is the dumping of sewage and waste in the harbor. As the Hong Kong Policy Research Institute states, “Every year, more than 150 million liters of untreated wastewater is discharged into the sea, ... [as opposed to] 50 million liters in the UK [United Kingdom].” As a result of this untreated waste dumping, 20 percent of Hong Kong oysters had Hepatitis A virus and an average cadmium concentration 40 percent above standard in 1997. (Hong Kong Policy Research Institute) The presence of the virus and heavy metal in the shellfish population indicates that pollutants are making their way into the population via the food chain.

A pollution-induced “red tide” took hold in spring 1998 containing *Alexandrium excavatum*, an organism deadly to humans. (Koon-kwai and Chi-sum, p. 385) Red tide is an algae bloom that is toxic to fish and tends to kill off fish stocks and poison the food supply. It is caused by nutrient-rich seawater containing high concentrations of nitrogen and phosphorous. This particular red tide was blamed on El Nino and heavy pollution from the Pearl River Delta Region surrounding Hong Kong. The slow flushing characteristics of seawater in the region contribute to the accumulation of nutrients in the harbor. (Hong Kong Policy Research Institute)

River water quality around Hong Kong is also poor. The Shing Mun River in Hong Kong has had high concentrations of *E. coli*, which is an indication of water contamination by sewage or agricultural runoff. The Dongjiang River on the mainland is Hong Kong’s primary drinking water source; however, the quality of this water is in doubt. The Guangdong Province claims that the water meets People’s Republic of China

(PRC) standards, but university studies indicate the water is still heavily polluted. (Hong Kong Policy Research Institute) The Hong Kong Policy Research Institute expresses the following concern: “Some of these pollutants can cause toxicological effects and affect children’s growth.” While the sources of this pollution are not within the boundaries of the Hong Kong Special Administrative Region (HKSAR), 80 percent of HKSAR’s drinking water is sourced from the Dongjiang, so it is of great importance in the analysis of Hong Kong’s environment. (Hong Kong Policy Research Institute)

Recent Food Supply Concerns and Environmental Awareness

In addition to water and air quality concerns, there have been other environmental scares that have created fears about the food supply and the environmental situation. For example, there have been two separate outbreaks of bird flu in the chicken “crop.” While these epidemics do not appear related to pollution, they have frightened the public and heightened both health consciousness and awareness of air, food and water quality. Additionally, foodstuffs arriving from the mainland are known to contain dangerous growth hormones and pesticides.

Why has the environmental situation in Hong Kong become a concern only in the last 15 years? A study of the first Legislative Council (LegCo) elections showed that environmental issues have not yet become political priorities. (Koon-kwai and Chi-sum, p. 391) Nonetheless, recent health and environmental disasters have sounded the environmental alarm. (Koon-kwai and Chi-sum, p. 399) Additionally, as a population grows wealthy, it tends to seek to improve its quality of life.

Environmental Protection Department Policies¹

Faced with the deteriorating environmental situation in the city, the EPD has initiated several programs and policies since its founding to reduce pollutant emissions. Many of these programs have been successful in reducing air pollutants and enhancing water quality.

Air Pollution Policies

Two types of controls have been introduced to decrease industrial emissions in Hong Kong. In 1987 license control was imposed on major pollutant-producing industries. This policy requires industries to purchase licenses based on the mass of pollutants released. Since the number of these licenses available is limited to control total pollutants released, industries are required to reduce their emissions. In the ten years since the enactment of this policy, emissions from industry have been reduced by 55 percent. Additionally, high sulfur content fuels were banned in 1990, which has led to an 80 percent decline in sulfur dioxide concentration in the atmosphere of industrial areas.

The Hong Kong government has also acted to reduce air pollution from power generation. Natural gas has been substituted for coal-fired boilers for steam generation in new power plants. Additionally, active coal power plants have been retrofitted with desulfurization systems to scrub flue gases. These two actions reduced annual sulfur emissions by approximately 80,000 tons in 1997. In addition to sulfur emissions from power plants, nitrogen emissions have also been curtailed. Low NO_x (nitrogen monoxide and nitrogen dioxide) technology has been retrofitted in boilers constructed after 1991,

¹ Information in this section is drawn from Hong Kong Policy Research Institute unless otherwise noted.

and existing systems have had low NO_x burners installed. These two upgrades have reduced NO_x emissions by two-thirds from 1991 to 1997. Reducing NO_x emissions is important because NO_x gases lead to the formation of ozone in the lower atmosphere.

To reduce the number of solid particulates in the breathable atmosphere, the government introduced a construction dust regulation in 1997. This regulation requires construction projects to minimize dust sent into the atmosphere during projects. An example of dust mitigation would be wetting open work sites to prevent dry dirt from being kicked up into the atmosphere. Initial data indicates that dust has been reduced by 80 percent.

Emissions from motor vehicles can be divided into two groups: emissions from gasoline-powered engines and those from diesel-powered engines. In Hong Kong, 30 percent of registered vehicles are diesel, and they account for 70 percent of the mileage traveled in the city. Gasoline powered motor vehicles have been regulated with respect to fuel composition and emission systems. Leaded gasoline was banned in the city in 1999, which eliminated lead emissions from vehicles. Catalytic converters have also been introduced into the Hong Kong motor vehicle market. As a result of market incentives and new vehicle purchases, which require the use of catalytic converters, 75 percent of gasoline-powered vehicles now have catalytic converters. These converters reduce NO_x and unburned fuel emissions by 90 percent. Converters also reduce carbon monoxide emissions by 90 percent. Controls on evaporable emissions were initiated for new vehicles in 1999, leading to a 90 percent decrease in volatile organic compounds (VOC) from individual vehicles. VOC controls also apply to new motorcycles with a consequent 50 percent decrease in emissions.

Regulation of diesel vehicles is more stringent and comprehensive than regulation of gasoline vehicles due to the heavy use of diesel vehicles in Hong Kong. Sulfur fuel composition limits for diesel fuel were systematically decreased over the 1990s: 0.5 percent before 1995, 0.2 percent in 1995 and 0.05 percent in 1997. Reducing the sulfur content of diesel fuel reduced annual sulfur dioxide emissions by 90 percent in 1997. Diesel engines have been required to meet Euro II emission standards since 1997, leading to a decrease of RSP (Respirable Suspended Particulates) by 80 percent and NO_x gases by 20 percent by meeting those standards. Standards for registering a diesel private car in Hong Kong have been made so stringent that no new diesel private cars have been registered since 1997. Additionally, all new taxis purchased after 2000 have been required to use liquefied propane gas (LPG). An LPG taxi fleet will eventually reduce RSP emissions by 30 percent annually.

Water Pollution Policies

The Environmental Protection Department has revised Hong Kong's Sewage Master Plan (Hong Kong's wastewater infrastructure plan) to upgrade the sewage network and prevent dumping of sewage in Hong Kong waterways. Approximately HK\$2 billion has been spent since the revision to enhance the system. The sewage system has been extended into rural areas of Hong Kong, and collected sewage is now chemically treated before being discharged into the sea. Additionally, the primary discharge pipe is being extended from Hong Kong waters out to the deep sea in order to enhance dilution of waste. By lengthening the discharge pipe to deeper water, a constant flow of waste is diluted in a much larger volume of water. The dumping of livestock

waste has been reduced from 1.6 million kg/day to 50,000 kg/day, and chemical waste discharge reduced by a factor of seven. (Loo)

In order to improve the quality of drinking water, a liaison group has been formed between the HKSAR and Guangdong Province. The group has instituted a number of measures, including:

- Relocating the water intake point upstream from its current position to avoid pollution from a Dongjiang river tributary,
- Constructing a bio-nitrification plant in the Shenzhen Reservoir to clean the water there,
- Converting the open-air aqueduct currently in use to a closed one to prevent pollution from entering the aqueduct bringing water to the city.

Additional funds have also been allocated and spent on treatment processes that filter sediment and correct pH levels. (Hong Kong Policy Research Institute) These systems will remove pollutants from the water and adjust the pH of drinking water to more acceptable standards.

In addition to sewage and drinking water issues, the EPD is acting to improve waterways within the HKSAR. Water Control Zones have been established by the EPD in which all discharges are monitored and controlled. Additionally, the condition of public bathing areas within Water Control Zones is monitored and reported to the public. (Loo) As a result, many public bathing areas have become cleaner, while areas that are still dangerously polluted have been closed to public bathing.

Sustainability

Now that I have explained the existing environmental and regulatory situation in Hong Kong, I will examine the efforts to address sustainable planning in Hong Kong. Sustainable development and planning is a broad concept bringing all levels of environmental, economic and social planning into the decision making process. In autumn 1997, the HKSAR government commissioned the Study on Sustainable Development for the 21st Century in Hong Kong (*SUSDEV 21*) as a first step to bring sustainability into planning and decision-making. The Brundtland Report, drafted by the World Commission on Environment and Development, brought to world attention the urgency of a commitment to sustainable economic growth that would not deplete world resources or pollute the environment. The World Commission offered a broad definition of sustainability: “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” (*SUSDEV 21*, p. 20) In the paragraphs that follow, I review the *SUSDEV 21* report, focusing on the definition of sustainability in Hong Kong and the system implemented to address future impacts of current decisions.

From the broad and internationally accepted definition offered by the Brundtland Report, a definition fitting the unique situation in Hong Kong was developed by the commission drafting the *SUSDEV 21* report:

Sustainable development in Hong Kong balances social, economic, environmental and resource needs, both for present and future generations, simultaneously achieving a vibrant economy, social progress and a high

quality environment, locally, nationally and internationally, through the efforts of the community and the Government. (p. 21)

The goal of this definition was to provide an overall guide, similar to a corporate mission statement, to lead the *SUSDEV 21* commission through the rest of its analysis and to provide the government and public with a working definition of sustainable development. *SUSDEV 21* expands the definition further into specific objectives that are applicable to particular sectors and interests:

- Economy – Hong Kong should achieve a competitive and prosperous market-based economy, which provides the resources to meet the needs and aspirations of the population, both now and in the future.
- Health and Hygiene – Hong Kong should promote a living and working environment and pursue policies which promote and protect the physical and mental health and safety of the people of Hong Kong.
- Natural Resources – Hong Kong should promote the sustainable use of natural resources to minimize its ecological footprint through improving consumptive efficiency, minimizing the use of non-renewable resources and re-using, recycling waste and recovering energy from wastes.
- Society and Social Infrastructure – Hong Kong should foster a stable, equitable, ethical and progressive society and enable present and future individuals to contribute to and fulfill their potential by

providing universal access to adequate and appropriate educational opportunity and social infrastructure.

- Biodiversity – To maintain the biodiversity of Hong Kong and to minimize any threat which consumption in Hong Kong may have on biodiversity elsewhere. [sic]
- Leisure and Cultural Vibrancy – Protect and enhance the vibrancy of Hong Kong’s recreational opportunities, leisure activities, cultural diversity, archaeological, historical and architectural assets. [sic]
- Environmental Quality – Hong Kong should be pro-active in avoiding environmental problems for present and future generations, seek to find opportunities to enhance environmental quality, and minimize the unwanted side effects, locally, nationally and internationally, of development and inefficiencies such as air, noise and water pollution or land contamination.
- Mobility – Hong Kong should provide safe, accessible, efficient and clean transport systems and pedestrian facilities along with an efficient transport network for the safe movement of goods and facilitation of services for the community. (*SUSDEV 21*, p. 23)

As the above objectives, or “Guiding Principles,” indicate, sustainability goes beyond economic growth and environmental protection. It is an all-inclusive framework for guiding all planning decisions, with regard to education, infrastructure, quality of life,

environmental awareness, etc. In other words, sustainable development touches on all aspects of society and is not just an environmental or economic concern.

In order to measure the effects of a change in policy or a development project with respect to the Guiding Principles, indicators have been derived for each principle. These indicators are designed to explain how the environment, society and the economy change over time. The indicators can provide a quantitative analysis of how new projects impact sustainability objectives, for example by tracking Air Quality Objective indices to determine how a particular policy or project actually affects air quality. The indicators examine “output,” or effects, of change in place of the “drivers,” or causes, of change focusing on quantitative measure of the impacts of a project. The selection of outputs as opposed to drivers reinforces one of the key concepts of sustainability, *the impact of change is paramount as opposed to the particular change itself*. Some examples of these indicators are listed below; *SUSDEV 21* contains a more comprehensive listing.

(*SUSDEV 21*, pp. 27-28)

- *Economy* – Economic return as determined through cost-benefit analysis;
- *Natural Resources* – Quantity of municipal solid wastes;
- *Society and Social Infrastructure* – Average length of waiting list for public rental housing;
- *Biodiversity* – Area[s] of Hong Kong of high terrestrial ecological value, [for example, ones that contain a great number of species];
- *Leisure and Cultural Vibrancy* – Number of recorded archaeological sites;

- *Environmental Quality* – Composite index for Criteria Air Pollutants based on percentage of the Air Quality Objectives, which is the overall pollutant total for each of the polluting gases;
- *Mobility* – Average travel distances for citizens to and from work.

SUSDEV 21 provides the government with a framework that can be used in planning and proposal evaluation. For example, applying the *SUSDEV 21* framework to a proposed construction project in an urban area of Hong Kong would cause the planning group to ask how the project and the new structure would affect air quality, water quality, the biodiversity of Hong Kong, driving times and demands on public housing due to the increased number of jobs. If the positive impacts of the project, such as economic growth or decreased poverty, outweigh the negative impacts, or if the negative impacts have been addressed and reduced through engineering or better design, the project would be approved. The *SUSDEV 21* commission also concluded that efforts needed to be made to raise the awareness of sustainability in the population. The commission also believed that community involvement is critical. In short, not only must the decision-makers be involved in Hong Kong's sustainability strategy, but the actors as well.

Conclusion

Hong Kong's environment has for some time been in a deplorable state, but the environmental situation has begun to improve in recent years indicating hope for the future. Evidence shows that while air and water quality have improved over the last decade, they do not yet meet Hong Kong's own standards and objectives. The EPD has enacted several successful remediation policies, but these are mostly focused on reducing pollutant releases into the environment.

With the completion of the *SUSDEV 21* study, Hong Kong is beginning to examine the future impacts of its policies and new project proposals. Development is beginning to move beyond merely raising economic and environmental concerns to calling for a more complete analysis of its impacts on society, environment and economics, both locally and internationally.

The Hong Kong government has taken the first critical steps to combat its environmental issues: it has identified them and is beginning to take comprehensive actions to solve them. All in all, the city has come far in recent years in establishing the framework for moving beyond pollution and into integrated planning and development.

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