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INTRODUCTION

Over the past decade, environmental protection has attracted increasing worldwide attention. In general, people of developed countries and fast growing developing countries have created and accumulated more wealth than the other developing countries. The growing affluence of people leads to demands for a better quality of living environment and results in creation of initiatives for promoting environmental protection. In addition, various kinds of environmental pollution not only cause negative effects on the environment but also have a long term deteriorating impact on the earth.

The provision of environmental protection solutions are generally carried out in two aspects: to abate the existing environmental problems and to provide environment friendly products which help to prevent further environmental problems.

ENVIRONMENTAL PROBLEMS IN HONG KONG

Throughout the 1970s and 1980s, industrial pollution pervaded local waters and local air. Since then, Hong Kong has become an important financial center in the region and no longer heavily depends on the manufacturing industry. However, pollution problems in Hong Kong have yet to be resolved. The development of Hong Kong's economy, together with the geographical limitation and population pressure on Hong Kong, has intensified the pollution problems.

Hong Kong is a small place with enormous pressures on its environment. Its population has grown by at least one million people every decade over the past fifty years. There are now over 6.97 million people crammed into about 1,000 square kilometres, who all need housing, water and other living necessities.

At the same time, the economy of Hong Kong has burst forth with its demands for land in housing the population and in accommodating the business establishments growing rapidly. The increase in road traffic has led to the construction of more roads.

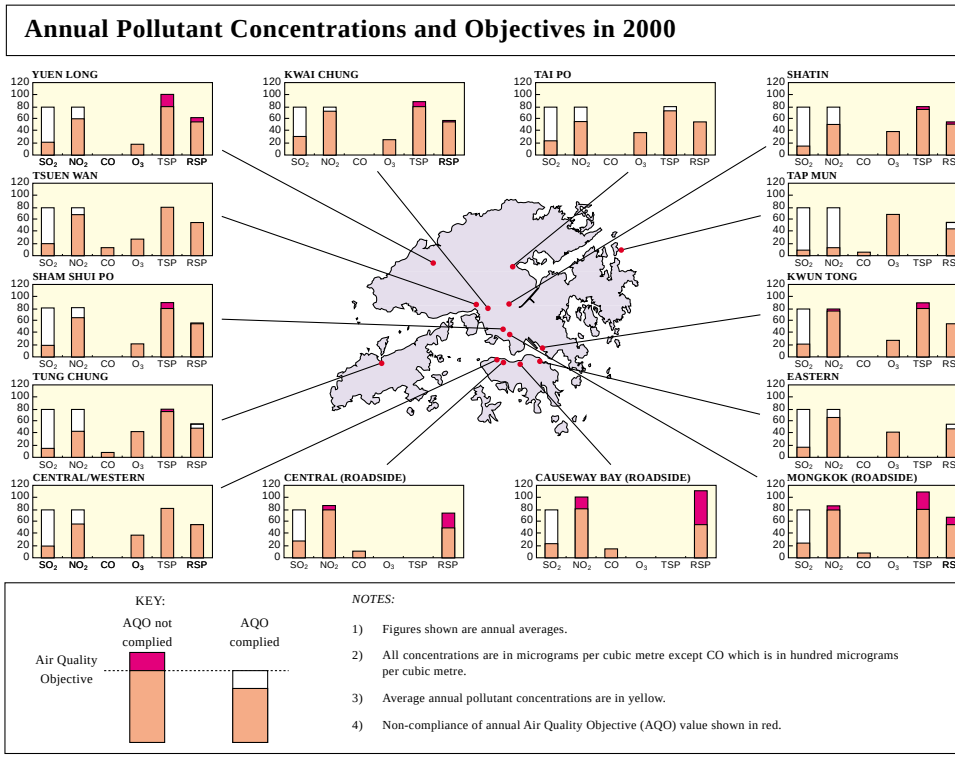
The consequence of the rapid development of the overall economy of Hong Kong is that infrastructure and building constructions have been built speedily over the past 20 years, but many such developments did not properly consider the negative consequential impacts on the environment.

Today the environmental problems in Hong Kong are so severe that both the government and the community have paid more attention to the issue. It is clear that pollution brings about health hazard to the citizens. Moreover, acute pollution problems will inevitably give travellers and international investors a negative impression of Hong Kong which in turn may hinder the development of tourism and deter the establishment of business operation in Hong Kong. In response to these various concerns, the 1999 Policy Address of the Chief Executive of Hong Kong was the first time that the environment had ever been figured so prominently in a high-level policy announcement. Both short and long-term strategies to tackle the pollution problems and to protect the environment from future damages were laid down in the Policy Address.

Air pollution: Problems caused by diesel vehicles

Pollution at street level, mainly caused by vehicle emissions, has been cited as one of the major causes of air quality deterioration in Hong Kong. As compared with other cities in developed countries, the average road utilisation rate in Hong Kong is at a level which is four and five times higher than the respective rates in Japan and the United Kingdom. 30% of existing fleet of vehicles in Hong Kong are diesel-powered while there are only 17% and 10% of existing fleet of vehicles in Singapore and the United Kingdom respectively are diesel-powered. Diesel vehicles account for nearly 70% of the total distance travelled on roads in Hong Kong. Hence, diesel vehicles account for about 52% of the respirable particulates and for about 60% of the ambient nitrogen oxide in the air throughout the urban area in Hong Kong. The average level of respirable particulates in Hong Kong, as recorded at most of the air quality monitoring stations operated by the EPD, is about 50% higher than that in New York. The average level of respirable particulates in Hong Kong also consistently approaches or exceeds the maximum level laid down in the Air Quality Objectives of the Hong Kong government. (Source: The 1999 Policy Address of the Chief Executive, Tung Chee-hwa)

Figure 1 below shows the comparison between the annual average pollutant concentration for 1999 collected by the EPD at its air quality monitoring stations and the Air Quality Objectives established by the Hong Kong government in 1987 under the Air Pollution Control Ordinance (Chapter 311 of the Laws of Hong Kong).



Glossary used in Figure 1:

"AQO"	Air Quality Objective established by the Hong Kong government in 1987
"CO"	carbon monoxide
"NO_2"	nitrogen dioxide
"O_3"	ozone
"RSP"	respirable suspended particulates
"SO_2"	sulphur dioxide
"TSP"	total suspended particulates

Figure 1: Annual average pollutant concentrations and objectives in 2000
(Source: 2001 annual report of EPD: "Environment Hong Kong 2001")

The above Figure 1 shows that the average level of respirable suspended particulate in Hong Kong is not acceptable according to the Air Quality Objectives.

Respirable suspended particulates are pollutants which can damage human lungs and have been linked in studies with higher death rates of human beings. The Hong Kong government considers that one of the key methods to prevent and abate air pollution at street level is to control the use of diesel vehicles which emissions is one of the major causes of air quality deterioration in Hong Kong. To this end, reducing the emission level of diesel vehicles and to gradually phase out diesel vehicle with vehicles powered by other cleaner source of energy, such as LPG or electricity and other measures have to be implemented.

The European emission standard for diesel, petrol and new vehicles and the Euro norms such as Euro I, Euro II and Euro III under European emission standard, which refer to different levels of permissible emission standards of vehicles, have been adopted and commonly referred to in Hong Kong. Each subsequent standard has a stricter emission standard than the previous one. In Hong Kong, all newly registered vehicles have to comply with stringent emission standards since 1995 and the emission standards have been progressively tightened. The Euro I standard was adopted in 1995 and the Euro II standard was adopted by various stages since 1997. The emission standard has been further tightened to Euro III standards in January 2001 for new vehicles up to 2.5 tonnes and legislation requiring the compliance of Euro III standard by new vehicles over 3.5 tonnes is expected to come into effect in late 2001. For the new vehicles weighted not more than 3.5 tonnes, the requirement for complying with Euro III standard will come into effect in January 2002.

As short to medium-term measures to deal with air pollution caused by diesel vehicles in Hong Kong, the Hong Kong government has launched the Voluntary Installation and Subsidy Program in September 2000. Under the program, the Hong Kong government provides grants to about 42,000 diesel light vehicle owners to install particulate reduction devices for their pre-Euro standard diesel vehicles. Eligible grantees under the program are owners of private diesel cars, light diesel buses and light diesel goods vehicles with a gross weight up to four tonnes and first registered on or before 31 March 1995, as well as diesel taxis first registered on or before 31 December 1995. For diesel heavy vehicles which are above a gross weight of four tonnes, the Hong Kong government proposes to assist their owners to install diesel oxidation catalysts in 2001. As at the Latest Practicable Date, no official announcement has been made by the Hong Kong Government in respect of the official launch of any subsidy program to heavy diesel vehicles owners for the installation of diesel oxidation catalysts. In 1999, there were about 50,000 diesel heavy vehicles in Hong Kong.

The Hong Kong government plans that commencing from around 2002, all pre-Euro standard diesel vehicles, which are diesel vehicles produced before the introduction of Euro I standard in 1992, will be required to be retrofitted with diesel oxidation catalysts or particulate traps before renewing their registration. Since January 2001, the Hong Kong government has adopted the more stringent Euro III emission standard and no new diesel vehicle may be imported unless it complies with the Euro III emission standard.

To complement the measures of emission standards, the Hong Kong government has also launched stricter enforcement actions. Starting from 1 November 2000, all fuel consuming vehicles (except motorcycles, motor tricycles and vehicles manufactured before 1 January 1975) have been required to have their exhaust emissions tested in their annual roadworthiness test. In addition, the fixed penalty for smoky vehicles was increased from HK$450 to HK$1,000 with effect from 1 December 2000.

Noise pollution

The Noise Control Ordinance (Chapter 400 of the Laws of Hong Kong) was introduced in 1989 to control noise pollution. Under the Ordinance, noise from construction sites, intruder alarm systems installed in any premises or vehicle and noise from domestic premises and public places are generally controlled and breaches of the Ordinance are considered as committing offences. In addition, manufacturing and/or use of noisy equipment emitting noise in excess of the standard prescribed under the Ordinance is also an offence. Despite the enactment of the Ordinance, 10,000 complaints in relation to noise pollution were recorded in 1999.

Apart from the above-mentioned sources of noise pollution, noises created by road traffic and aircraft traffic are also major sources of noise pollution in the urban areas. The noise pollution created by aircraft was substantially alleviated by the relocation of the airport in Kai Tak to Chek Lap Kok in 1998. Since the move of the airport from Kai Tak to Chek Lap Kok, less than 200 persons are affected by aircraft noise above generally accepted standards of about 65 to 70 dB(A) in accordance to the updated statistics contained in "Environment Hong Kong 2001", as compared with 380,000 persons affected before the relocation of the airport.

Hence, noise from ground transport is currently the major concern of the Hong Kong government among the other sources of noise pollution. It was estimated by the EPD in 1999 that about one million people or more than 15% of the population in Hong Kong is exposed to road traffic noise of about 70 dB(A). As shown in Figure 2 below, the level of population exposed to road traffic noise (above 65 dB(A)) ranked third among those countries included in the chart.

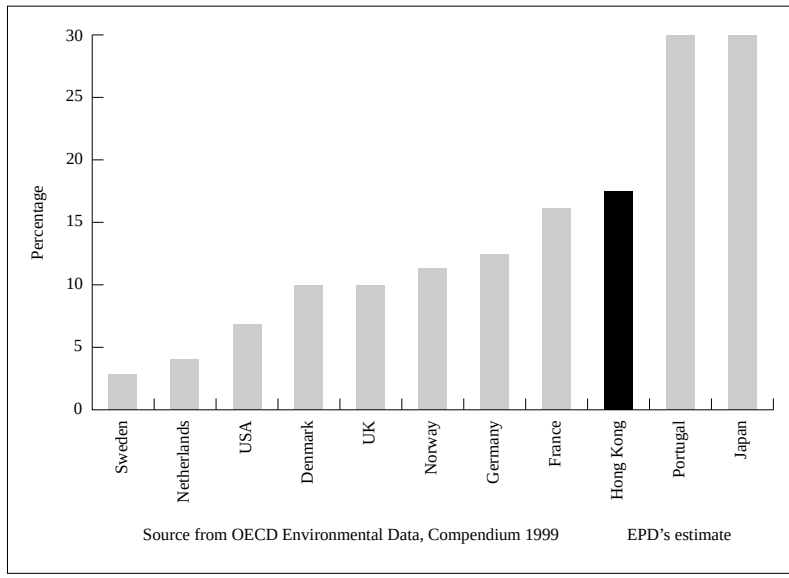


Figure 2: Proportion of population exposed to road traffic noise (above 65 decibel in "A" scale per day) (Source: 2000 annual report of EPD: "Environment Hong Kong 2000")

Similar to aircraft noise, road traffic noise in Hong Kong is also a planning problem. Busy highways run through the middle of residential districts at the eye-level to people's living rooms. Railway yards are erected next to residential blocks. But unlike the airport, the roads and railways cannot be removed, and it would severely limit economic activity to restrict their hours of usage. Other solutions have had to be found.

Road traffic noise is being addressed at two levels. Firstly, more careful consideration has been given by the Hong Kong government to the planning of new roads and the layout of new developments to minimize noise impacts. Good planning is the best long-term option.

Secondly, existing road noise has to be abated effectively. Roads are being re-surfaced with materials which would produce less noise, where possible. Schools affected by road noise, rail noise or aircraft noise, have been insulated with noise proof materials. The proposal of retrofitting noise barriers on existing roads and along the tracks of the Kowloon Canton Railway Corporation is being discussed between the relevant authorities. Subject to the approval by the Legislative Council, the Hong Kong government is prepared to build noise barriers on existing roads and flyovers if people living nearby are exposed to the level of noise above 70 decibels. As a result, it is estimated that the retrofitting of noise barriers would have to be done on more than 29 roads and flyovers. The total estimated cost for this project is about HK$2.34 billion.

Waste management

In 1989 the statutory Waste Disposal Plan was unveiled under the Waste Disposal Ordinance in 1989, setting out a 10-year plan for developing new waste management facilities and closing the old ones. The Waste Disposal Plan sets out a strategy for municipal solid waste disposal in Hong Kong. This includes a programme for the phasing out of old waste facilities and the development of new and cost-effective facilities of higher environmental standards, under the management of the EPD.

The new facilities include three strategic landfills and a network of refuse transfer stations. The three landfills have a total capacity of about 135 million cubic metres that would cater for waste arisings over the next 10 to 15 years. Seven refuse transfer stations are operating and another three will be commissioned over the next few years. The total handling capacity of the transfer stations will reach 14,500 tonnes a day by 2007.

The following Figure 3 shows the quantity of municipal solid waste disposed of and recovered in each year from 1990 to 2000.

Quantity of Municipal Solid Waste Disposed of and Recovered 1990-2000

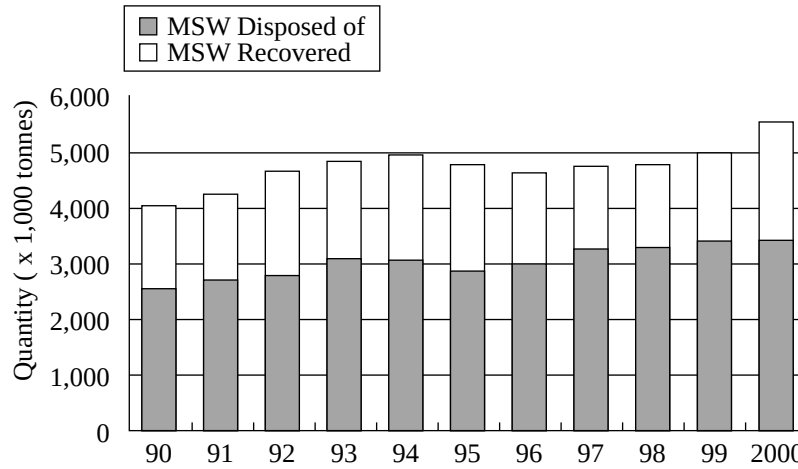


Figure 3: Quantity of municipal solid waste disposed of and recovered in each year from 1990 to 2000 (Source: 2001 annual report of EPD: "Environment Hong Kong 2001")

According to 2000 annual report of EPD "Environment Hong Kong 2000", about 9,300 tonnes of municipal solid waste were dumped in landfills every day in 1999, up from about 6,000 tonnes in 1986, and construction waste loads fluctuated between 6,000 to 16,000 tonnes a day throughout the 1990s in Hong Kong. According to 2001 annual report of EPD "Environment Hong Kong 2001", municipal waste grew by 32 per cent. between 1990 and 2000, to 9,350 tonnes per day. There are three large state-of-the-art landfills which were built in the 1990s, at a cost of $6 million. They were expected to accept waste until at least 2020. But population growth and construction waste have skewed the figures that were used to plan the landfills. All three landfills in West New Territories, South East New Territories and North East New Territories will be full by about 2015 at the latest, even with better recycling and waste reduction. If construction waste loads should increase or if alternatives are not found for the waste, then the Southeast New Territories landfill could run out as early as 2005. Hence, as stated in the "Waste Reduction Framework Plan" released by the EPD, given the lead time required to create a modern landfill, about another 860 hectares of space will have to be identified for new landfills within the next few years to serve Hong Kong from 2016 up to 2045. This is almost two-thirds the area of the new airport at Chek Lap Kok, or almost sufficient land to house Hong Kong's population growth for the next decade.

The urgency of the problem was addressed in the Waste Reduction Framework Plan unveiled by the Hong Kong government in November 1998. Its immediate goal has been to almost double the recycling of municipal waste from 30% in 1998 to 58% by 2007. Aiming to this target, supports have been provided by the Hong Kong government. Land has been identified for recyclers, collection facilities have been set up in public and private housing estates, and it was announced in the 1999 Policy Address of the Chief Executive of Hong Kong that the Hong Kong government would seek funds in 2000 to build waste separation facilities. In addition, the Waste Reduction Framework Plan has also aimed to improve the recovery rate for domestic waste which is only around 8%, while that for commercial and industrial sector is about 53% in 1999 and 2000. A waste-recycling scheme in housing estates that began in 1998 was extended to 300 private and public housing estates in 1999. For commerce and industry, the Wastewi$e Scheme, a scheme aiming to promote waste recycling, was launched by the EPD in June 1999 to recognise companies that achieve their recycling targets.

According to the 2001 annual report of EPD "Environment Hong Kong 2000" through the existing informal and voluntary waste recovery system, about 1.85 million tonnes of municipal solid waste was recovered in Hong Kong in 1999, representing about 35% of the total municipal solid wastes produced in the city in that year. According to the "Facts Sheets regarding recovery and recycling of plastic waste in Hong Kong" released by the "Waste Reduction Committee", waste plastic is one of the main components in municipal solid waste and constitutes 15% to 20% by weight and around one third by volume in the waste stream. In 1999, about 153,500 tonnes of waste plastic were recovered in Hong Kong, representing about 23% of the total waste plastic being produced in Hong Kong in that year. Of those 153,500 tonnes waste plastic, only 15% or 22,500 tonnes were recycled locally, while the remaining 85% or 131,000 tonnes were exported to the PRC or other countries for recycling. Therefore, there is room for further development of the waste plastic recycling business in Hong Kong.

Further, the Hong Kong government considers that waste-to-energy conversion is another measure for waste management. Waste to energy is a proposal to burn combustible municipal solid waste to recover energy and reduce the volume of waste which will be disposed ultimately. The Hong Kong government is now conducting a feasibility study on the development of a waste-to-energy incinerator which will help to reduce the volume of waste requiring final disposal and to recover energy from the burning process. Thus, there is business opportunity for any innovative waste management process which is in line with the Hong Kong government's strategy to turn waste to energy.

ENVIRONMENTAL PROBLEMS IN THE PRC

Air Pollution: Problems caused by diesel vehicles

In the PRC, vehicle emissions are blamed by the PRC-EPA to be a main source of air pollution in urban areas, and cities like Guangzhou and Beijing are among the worst polluted cities in the world.

In 1999, PRC-EPA estimated that there would be a total of about 60 million vehicles in the PRC in 2000, about 5.8 million and 1.0 million of which would be diesel light and heavy vehicles respectively. According to the PRC-EPA, the existing road infrastructure cannot cope with the rapidly increasing vehicle fleet. As a result, most of the vehicles in the PRC travel at low speed and thus generate higher than normal emission into air, and the average emission factors of vehicles in the PRC are several times higher than those in the developed countries. Official figures released by the PRC-EPA reported severe air pollution problems in Beijing and Guangzhou:

- there is very serious NOx pollution in Beijing and Guangzhou. As shown in Figure 4 below, the NOx level in these two cities were almost triple of the national standard in the PRC in 1997;

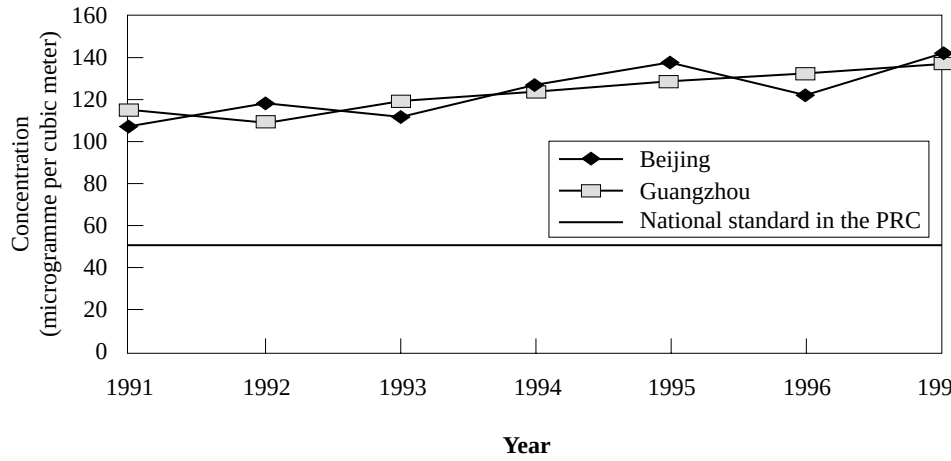


Figure 4: NOx level in Beijing and Guangzhou compared with the national standard in the PRC (Source: "Motor vehicle emission control in China", PRC-EPA)

- daily average CO concentration is higher than the second grade national standard in the PRC of 4mg/m^3 in traffic areas; and

- there is serious particulate pollution problem in Beijing and Guangzhou. The particulate levels are of 377g/m^3 and 295g/m^3 in Beijing and Guangzhou respectively in 1995. These levels are significantly higher than the normal acceptable standard which is about 0.20g/m^3.

After taking into account the increase in vehicle usage, it was estimated by the PRC-EPA that if no effective emission control is implemented in Beijing, CO and NOx emissions in the urban area of Beijing in 2010 would increase to a level of about 4 times of that in 1995.

Long-term strategies and measures including adoption of stricter vehicle emission standards for new vehicles, phasing out of leaded gasoline and using unleaded gasoline are planned by the PRC-EPA to be carried out in the PRC. In particular, to tackle those problems related to vehicles in-use, inspection/maintenance program ("I/M Program") has been adopted in the PRC. The I/M program includes improving annual examination for motor vehicles and reinforcing monitoring systems. The municipal environmental protection bureau will adopt measures such as implementing stringent emission standards. Such standards will be measured during the annual examination for motor vehicles. For those vehicles which do not comply with the standards, no licence will be granted or they may be suspended from use until full compliance with the standards. Under the I/M Program, replacement of old vehicles is expected to accelerate, or those old vehicles still in use will be required to be retrofitted with emission control devices so that the stricter vehicle emission standard can be met.

Further, imposition of charges on the owners of vehicles emitting pollutants will be adopted in the major cities in the PRC. Currently, a few cities in the PRC, including Beijing, Shanghai, Gulin, Chengzhou and Hanzhou have either adopted or are prepared to adopt the charges.

HYDRAULIC FILTERS AND THE RELATED HYDRAULIC INDUSTRY

Hydraulic filters are necessary components of hydraulic systems, which are broadly applied to construction, agricultural and industrial machinery to help the transmission of energy and power between components of the machinery. Hydraulic filters can help to abate environmental problems in relation to contaminated hydraulic oil being consumed by hydraulic systems for trapping the particulate in the hydraulic oil so as to abate contamination and to extend usable life of the hydraulic oil. Every hydraulic system therefore accommodates at least one filter for hydraulic oil maintenance purpose. In some dedicated hydraulic systems with servo-valves, three to four hydraulic filters are employed.

Hydraulic oil is important to the proper operation of every hydraulic system as it (i) acts as an energy transmission medium; (ii) lubricates internal moving parts of components of the hydraulic system; (iii) acts as a heat transfer medium; and (iv) seals clearances between moving parts of components of the hydraulic system. Those functions will be impaired when the hydraulic oil is contaminated. Damages caused by contaminated hydraulic oil to the hydraulic system include orifice blockage, wear of hydraulic system components, formation of rust or other oxidation, depletion of additives and bacterial growth. As a whole, the running of the hydraulic system and in turn the machinery to which it is installed will be adversely affected. Most of the hydraulic system failures are caused by contaminated hydraulic oil. Therefore, contaminated hydraulic oil has to be disposed of and replaced by clean oil frequently.

The improper disposal of contaminated hydraulic oil will however cause environmental problems such as water pollution and soil contamination. Furthermore, contaminated hydraulic oil accelerates the creation of industrial wastes of scrapped hydraulic and machinery components. In Hong Kong, hydraulic oil, being classified as chemical waste, must be collected by a licensed waste collector for proper disposal.

Hydraulic filters are accommodated into hydraulic systems to continuously filter the hydraulic oil and to extend the usable life of the hydraulic oil which in turn contribute to reduce the adverse effect on the environment.

According to the International Industry Statistics in 1996, the hydraulic industry in the PRC, with the total gross production value of RMB2,348 million (equivalent to about HK$2,215 million), ranked the sixth in the world.

It is anticipated by 中國液壓氣動密封件工業協會 (The Association of Fluid Power Industry in the PRC) that the market demand in the PRC for hydraulic system components will reach approximately 13,000,000 pieces with total revenue of RMB7,000 million (equivalent to about HK$6,604 million) in 2005.

In the PRC, pollution control on wastage caused by any hydraulic system failure, in particular that relates to contaminated hydraulic oil, is considered being important. However, the hydraulic industry in the PRC generally acknowledges that improvements in the design and production of the hydraulic system components (including hydraulic filters) are necessary to improve the quality and performance of the hydraulic systems.

In Taiwan, the sales volume of hydraulic industry was about NT$5,437 million (equivalent to about HK$1,376 million) in 1998. About NT$1,501 million (equivalent to about HK$380 million), representing about 27.6% of the said sales volume of hydraulic industry in Taiwan in 1998, was exported. The sales turnover of hydraulic system components including hydraulic filters in 1998 was about NT$1,248 million (equivalent to about HK$316 million) representing a growth of about 18% from that of the previous year.

In US, the largest consumers of hydraulic systems and hydraulic system components are the aerospace, construction equipment, heavy truck, agricultural equipment, machine tool, and material handling industries. These industries account for about 75% of the total consumption of hydraulic systems and related products in US. In 1996, US imports of hydraulic systems and hydraulic system components valued at about US$1.1 billion.