The University of Hong Kong

1999-2000 1st semester

GEOG1002: Hong Kong: Land, people and resources Research Paper

Topic of discussion: Environment

Title of Research Paper: Air pollution of Hong Kong

Name: Yung Yin Chun
Student Number: 1999043435

INDEX

Introduction

Related to the idea of "air pollution", it is ironically to say that there is no such "pure" air[1] in the world – that is 78% nitrogen, 21% oxygen and the rest are water vapour etc. The term "air pollution" applies when the amount of pollutants in air exceeds its normal standard.

The air pollution problem is not "new" in Hong Kong. The first Clean Air Ordinance was introduced in 1959 to control black smoke from factories[2]. The problem of air pollution at that period was mainly localised. It was usually found in localised area near to the source of emission[3] such as North Point, Hunghom where power plants were found, and Kwai Chung and Tsing Yi where industries concentrated[4].

Geographically, the mountainous and availability of high-rise buildings in the urban area further restrict the movement and the diffusion of air pollutants. In addition to hot and humid climate in the region[5], this results in the accumulation of seven main pollutants in Hong Kong, namely sulphur dioxide, total suspended particulates (TSP), respirable suspended particulate (RSP), nitrogen dioxide, carbon monoxide, photochemical oxidant (ozone) and lead[6].

However, if we compare the overall air pollution of Hong Kong, we will discover that our rank is somewhere near the middle of the scale. Hong Kong air

[1] Tong. W.F., 1997: *A study of suspended airborne particulates monitoring in Hong Kong,* The University of Hong Kong. p. 3
[2] *Ibid.,* p. 8
[3] Hong Kong: Committee in Air Pollution, 1970. *A Report on Air Pollution in Hong Kong.* Hong Kong Government Printer. P. 2
[4] Thrower, S.L., 1979. *Report on the results of clean air and lichens projects, 1979.*
[5] *Clean air for Hong Kong,* 1999. Hong Kong Bureau. p. 8
[6] http://www.info.gov.hk/epd/air/polsource.htm

pollution is similar to findings in Tokyo, Seoul and Kuala Lumpur[7]. It is clear that effort has been made to reduce the air pollution in Hong Kong.

In recent years, the general public is more aware of air pollution in Hong Kong. However, most of us seem to have a misconception about the term "air pollution". In the following paragraphs, a discussion on the concept of air pollution will be put forward first, and then the source, problems and solutions of air pollution will also be introduced.

Air Pollution in Hong Kong

When we talk about "air pollution", probably the first impression it gives you is related to the emission from vehicles, factories and etc. However, under the definition of "air pollution", it means more than that. We define the emission from vehicles and factories etc as "outdoor pollution", because they take place usually on the road. But we seems always forget that there is another source of air pollution in Hong Kong – indoor air pollution. The pollutants from new furniture and material renovation work, cooking stoves, photocopiers and cigarette smoking[8] etc also pollute the air indoors in Hong Kong! Hence the discussion of air pollution will be divided into two parts – outdoor and indoor air pollution.

Outdoor Air Pollution

Serious environmental pollution has been a by-product of Hong Kong's economic and population growth[9]. As the economy of Hong Kong advances, the

[7] http://www.info.gov.hk/edp/air/howpollute.htm
[8] Legislative Council, Panel on Environmental Affairs, *Control of Indoor Air Pollution.* http://www.info.gov.hk/edp/E/iaq/ea_pane1/ea2_eng.htm
[9] *Action against environmental pollution,* http://www.info.gov.hk/info/pollut.htm

emission from vehicles and power plants and factories around the region[10] is greatly increase. It is also found that emissions from diesel vehicles account for over 80% of (RSP) in Hong Kong[11]. They becomes the major sources of outdoor air pollution.

Health problems are arisen due to high level of outdoor air pollution in Hong Kong. Many studies between 1967 and 1980 have produced evidence that a number of environment factors are associated with respiratory diseases[12]. It is obvious that activities which bring about an air quality, and poor air quality is a daily threat to public health in Hong Kong[13].

Illnesses like chronic cough, chest illness and bronchitis are found and hospital admissions for various respiratory conditions and decrements in lung functions are resulted. They are mainly vulnerable children, the elderly, asthmatics and those doing heavy physical exercise[14]. For example, it had been discovered that primary school children studying in Kwai Chung and South District suffered more respiratory illnesses than children from other area of Hong Kong. It is also found that foot patrol and traffic police suffer more symptoms than marine police[15], since they inhale more air pollutants on the street when they are working.

Outdoor air pollution also has its impact on climate too. Particulate matter has caused atmospheric phenomena such as electrification phenomena, cloud formation and fog formation. Their presence in the atmosphere can reduce visibility interfere[16]. In fact, the visibility of Hong Kong has reduced to an extent that you can see less than

---

[10] Lam, A., *A cloudy view for the region.* http://www.info.gov.hk/edp/E/ehk99/home/english/ch2/p38.htm
[11] *Petition to the governor on air pollution and health,* 1995. Hong Kong: Friends of the Earth.
[12] Thrower, S.L., 1979. *op cti.*, p. 17
[13] Steinbrecher, N., 1997. *Sustainable transport for Hong Kong.* p. 6
[14] *Petition to the governor on air pollution and health,* 1995. Hong Kong: Friends of the Earth.
[15] Hong Kong: Department of Community Medicine, 1998. *The Health of Hong Kong Police: Finding from a health survey in traffic, foot patrol and marine police, with special reference to respiratory health, smoking exposure to environmental tobacco smoke and ambient air pollution.* The University of Hong Kong. p. 139 & 150
[16] Chan, S. F., 1995. *Application of Cluster Analysis to identify sources of particulate matter in Hong Kong.* The University of Hong Kong. p. 12

eight kilometres away – the equivalent of seeing no further than Tsing Yi Island from the Peak[17].

In order to maintain an acceptable level of air quality to safeguard the health and well being of the community, measures were taken to alleviate the problem[18]. The air pollution of Hong Kong, unlike the past, is never again a localized problem. For example, the relationship between Mainland China and Hong Kong has become closer after the handover of 1997. Drivers travelling frequently across the border can obtain low quality diesel fuel, which will result in air pollution. It is essential for both Hong Kong and China Government to cooperates closely to cope with air pollution[19].

This is why the Chief Executive Tung-chee-hwa argued in his recent policy address, "Hong Kong cannot possibly solve all of its environmental problems singly-handedly. We need to work closely with mainland authorities[20]", it is clear that the Hong Kong SAR and Guangdong Government cannot act alone because air pollution respects no boundaries, a joint effort must be made to clear the air[21].

General measures dealing with air pollution include scrubbers have been installed in the chimneys by the power companies to remove some of the pollution; factories are also facing stricter controls on their pollution and vehicles[22]; emission standard for newly registered diesel taxis has been tightened[23]. The number of smoky vehicles has been reduced. The use of chassis dynamometer has been introduced. Now drivers cannot cheat on smoke tests by starving the engine of fuel in order to make little smoke. Now it tests the engine by running on the road with the full load of

---

[17] Lam, A., *op. cti.*
[18] *Air Quality Objectives,* http://www.info.gov.hk/epd/E/ehk99/home/english/ch2/p46.htm
[19] Tong, W.F., *op. cti.*, p. 48-49
[20] *South China Morning Post,* 7th October 1999
[21] Lam, A., *op. cti.*
[22] *Ibid.*
[23] *Development of New Air Legislation,* http://www.info.gov.hk/epd/E/ehk99/home/english/ch2/p57.htm

the vehicle. The number of vehicles fails the new test doubled when compared with the previous standard[24].

At the end of 1998, 75% of petrol cars were fitted with 3-way catalytic converters and using unleaded petrol. After these efforts, the motor diesel becomes the cleanest in Asia. The diesel vehicle emission standards are in line with European standards[25].

The Environmental Campaign Committee was set up in 1990 to raise the environmental awareness of the community. Conservation Fund was set up to provide financial support to non-profit making organization to organise environmental education. Visit Centres were set up in December 1993[26].

Legislative measures have also been done to alleviate the problem of air pollution in Hong Kong. Though prosecution is not the complete answer to curb pollution, there is no doubt that eliminating dark smoke by prosecution would go far forward improving the situation[27]. All projected emission, except carbon dioxide, decline or increase to a small extent[28] as a result of legislative measures.

The Air Pollution Control Ordinance (APCO) had been put forward to deal with air pollution. For example, Air Pollution Control (Smoke) Regulations are to limit continuous dark smoke emission to three minutes; Air Pollution Control (Motor Vehicle Fuel) limits the sulphur content of diesel to no more than 0.2 per cent[29].

---

[24] *Testing the health of smoky vehicles,* http://www.info.gov.hk/epd/E/ehk99/home/english/ch2/p42.htm About 17 per cent of vehicles tested fail under the previous system; but the failure rate doubled to 34 per cent after the introduction of the new test.
[25] http://www.info.gov.hk/epd/air/programme.htm
[26] *Action against environmental pollution,* http://www.info.gov.hk/info/pollut.htm
[27] Hong Kong: Committee on Air Pollution, 1970. *op. cti.,* p. 9
[28] Steinbrecher, W., 1997 *op. cti.,* p. 40
[29] *Legislation for Management of Air,* http://www.info.gov.hk/edp/E/chk99/home/english/ch2/p54.htm

A ban on the sale of leaded petrol was in progress[30]. The installation and modification design of furnaces, ovens and chimneys is also controlled. Cleaner industrial fuel is introduced. Open burning of construction waste is prohibited[31]. Regulation requiring construction sites has been set up to implement mandatory dust suppression measure. Regulation controlling dust emissions from construction sites came into operational in Jung 1997[32].

The emission from diesel vehicles has been the major source of outdoor air pollution in Hong Kong. It is pointed out that "compared with other major cities, Hong Kong has a high level of respirable particulate emissions, owing to exceptionally large use of diesel fuel[33]". Diesel emission contains three major pollutants: respirable suspended particulates (RSP), nitrogen oxides and hydrocarbons. They both have a bad effect on the health of the people. RSP will contribute to lung diseases such as asthma, bronchitis and emphysema. Nitrogen Oxides will increase the risk of respiratory infections. Hydrocarbons will cause damage to the central nervous system, as well as cause eye irritation[34].

Past effort has been made to reduce the number of vehicles on the road, so as to decrease the amount of pollutants from diesel vehicles. Measures such as increase the cost of the private car is proposed. However, its effectiveness is not obvious. It is due to the fact that constant growth in GDP in previous years. It is also due to the fact that car is one of the main status symbols in Hong Kong and people do not mind to

[30] *Development of New Air Legislation,* http://www.info.gov.hk/epd/E/ehk99/home/english/ch2/p57.htm
[31] http://www.info.gov.hk/epd/air/programme.htm
[32] *Action against environmental pollution,* http://www.info.gov.hk/info/pollut.htm
[33] *Ibid.*
[34] *Clean Air: Further proposals to reduce emissions from diesel vehicles: Consultation proposal,* 1995. Hong Kong Government Printer. Annex C

pay more buy it. The Road Pricing Scheme is also politically sensitive[35]. As previous attempts were proven futile, this gives rise to petrol switching policy.

Since 1992 all new petrol cars have been required to have three-way catalytic converters which use unleaded fuel. Due to these measures the lead concentration in Hong Kong decreased significantly and the trend is continuing as more leaded petrol vehicles will be phased out[36].

However, there has been widespread objection towards the policy. It is criticised that no more incentives were launched to change the vehicle fleet[37]. Operators of taxis and minibus also oppose to the ideas since it may increase the operating costs[38]. They also worry about the reliability of petrol vehicles, since Hong Kong is characterised with steep terrain and long hot summers. Diesel engines are considered more reliable and durable than petrol engines when they are heavily loaded and used[39]. Also, it is extremely difficult to draw a conclusion whether diesel engines are more environmentally friendly than petrol engines. It is pointed out that Diesel engines with three-way catalytic converters produce less CO, CO_2, NO_X and HC's, but emission of NO_2, PM and climatically-active carbon particles are much higher[40].

As the effectiveness of petrol switching policy is questioned, a policy concerning the taxi industry has been proposed. It is pointed out that taxis in Hong Kong contributes mostly to the outdoor air pollution. Though taxis share not larger than 4% of total number of vehicles in Hong Kong, its total emission exceeds 20% of

[35] Steinbrecher, N., 1997. *op. cti.*, p. 51
[36] *Ibid.*, p. 23
[37] *Ibid.*, p. 23
[38] Sun, S., 1995. *The feasibility study of switching from the diesel to petrol light road transport to improve the urban air quality in Hong Kong.* The University of Hong Kong. p. 102. It is pointed out that the increase in operating costs are: (i) fuel cost; (ii) mountainous cost. It is also criticised this will lead to increase in fares and decrease the service demand and therefore a serious adverse impacts in their earnings and competitiveness of their business in the market.
[39] *Ibid.*, p. 103
[40] Steinbrecher, N., 1997. *op. cti.*, p. 57-58

all total emissions[41]. Being inspired by the great success of LPG taxis in Japan[42], the Hong Kong Government decides to introduce LPG taxis in Hong Kong.

It is estimated that from the end of 2000, all vehicles newly registered as taxi will use LPG. Encouragement is given to all diesel taxi owners to replace the taxis with LPG taxis before the end of 2005. The emission standard for newly registered diesel taxis will also be tightened, and stricter inspection on diesel taxis will also be carried out. However, between now and the end of 2000, taxis owners can choose whether to convert their taxis to use LPG on voluntary basis[43]. It is estimated that the total particulate emission will be reduced by 30% if entire taxis are switched to use LPG[44].

Advantages given by the Hong Kong Government is that LPG is as safe and reliable as diesel and can operate at a comparable price. It is also argued that LPG is virtually free of smoke and emits tiny levels of pollutant. The risk of explosion but nothing big happened – even though LPG taxis were involved in several accidents which front end was badly damaged[45].

However, there are also disadvantages mentioned. The long term price of LPG remains unclear, and since LPG taxis is something new in Hong Kong, the maintenance work have to be done by vehicle supplier, this will increase the maintenance cost[46]. It is also criticised that it is expensive to buy and maintain the environmentally friendly vehicles, and maintenance may be last for months[47]. Also, it

---

[41] Ming Pao, 2nd October 1999
[42] *A proposal to introduce LPG taxis: A consultation paper,* 1998. Hong Kong Printing Department. p.1. It is revealed that 90% of taxis in Japan are operated on PLG currently.
[43] Mok, W.C., *LPG taxis get green light.*
http://www.info.gov.hk/epd/E/ehk99/home/english/ch2/p40.htm
[44] *Ibid.*
[45] *Ibid.*
[46] *Ibid.*
[47] *South China Morning Post,* 7th October 1999

is hard to implement onto the Lantau Island "Blue taxis" because of lack of PLG filling facilities in Lantau Island[48].

The 1999 Policy address by Chief Executive Mr Tung Chee-hwa is characterised with environmental protection. 30 billions will be spent within next decade to reduce RSP in the air. Various measures including an increase of smoky vehicle fines, 1.4 billion grants to taxi, bus and truck owners for emission testing, installation of catalytic converters will be introduced. Pedestrian zones in Causeway Bay, Tsim Sha Tsui and Mongkok will also be developed. LPG in minibus will be started on April. Diesel bus will phase out and no diesel taxis will be available after 2006. Government bureaux and departments are required to publish reports on their environment policies and actions starting from the 1999-2000 financial year[49].

Indoor Air Pollution

Besides we always forget indoor air pollution, we also should not isolate indoor air pollution with outdoor air pollution. They are closely linked. It is pointed out that air pollutants indoor such as cooking fumes and odour are emitting through the exhaust dustings to the atmosphere[50]. Indoor pollutants will finally leak outdoor, and affect the atmosphere.

The major pollutant of indoor air pollution is carbon dioxide[51]. As mentioned before, the major source of indoor air pollution are pollutants from new furniture and material renovation work, cooking stoves, photocopiers and cigarette smoking. Indoor

[48] *Ming Pao,* 9th October 1999. It is pointed out that in Lantau Island there is no petrol filling station with PLG filling facilities. Though there is one in Tsing Yi, it is costly to be charged of $30 when passing through the Tsing Ma Bridge.
[49] *South China Morning Post,* 7th October 1999
[50] So, T.W., 1993. *Odour Nuisance from restaurants and its control.* The University of Hong Kong. p.81
[51] Legislative Council, Panel on Environmental Affairs, *op. cti.*

air pollution may also be arisen from the use of fuels for heating[52], which unburnt fuel may possibly cause air pollution indoor.

It is pointed out that the most serious indoor air pollution takes place in restaurants other than cinemas and shopping malls[53]. It is because that cooking fumes already emit carbon dioxide, water vapour, some organic vapour and gases and particulate matter. In addition to uncontrolled frying and cooking operations is common in local restaurants, a dense smoke of aerosol particles consisting of fat and other particulate matters is emitted, which create local odour nuisance[54].

The major cause of indoor air pollution, however, is the bad ventilation system, the low cleanliness of the ventilation system and carpets[55]. Bad ventilation system lowers the amount of carbon dioxide from emitting outdoor. Indoor air pollution resulted. Dirty ventilation system as well as dirty carpets both attracts bacterial growth. Illnesses are resulted if people are packed within an enclosed area.

Indoor air pollution may makes people tired and sleepy. It may irritate eyes and impair lung function, causing respiratory disease. It may therefore enhance the probability of cancer[56]. Onset of temporary amnesia may also results due to prolonged exposure to an odour[57].

Solutions have been put forward to alleviate indoor air pollution. The Smoking (Public Health) Ordinance designates no smoking areas in public. All indoor areas open to the public have been designated as no smoking area with effect from 1 July

[52] Thrower, S.L., 1979. *op. cti.,* p. 18
[53] Legislative Council, Panel on Environmental Affairs, *op. cti.*
[54] So, T.W., 1993. *op. cti.,* p. 1
[55] Legislative Council, Panel on Environmental Affairs, *op. cti.*
[56] *Ibid.*
[57] So, T.W., 1993. *op. cti.,* p. 11

1998[58]. It is commented that the legislative measure are effective in minimizing potential odour nuisances[59].

Instruments such as wet scrubbers, better afterburners are also installed in restaurants to alleviate the problem. However, the high capital cost[60] involved makes the solution impossible.

Conclusion

The efforts made in the pervious years, in theory, have been a great success. A comprehensive measures has been taken place, legislative punishments and financial incentives all encourage and force people to take action to alleviate air pollution. The public is cooperative due to its awareness on the seriousness of air pollution.

In practise, the problem of air pollution is difficult to be alleviated. The concept of the air pollution is always a "dynamic" one – it changes throughout the time. This explains why the problem of air pollution is always a concern for the society. For example, as mentioned before the air pollution problems in 1950s and 1960s are usually a localised matter. It happened near the source of pollutants. However, the problem of air pollution nowadays has become globalised. For example, in 1990s many of the industries in Hong Kong dispersed to Mainland China. This resulted in new air pollution problems, such as the emission from diesel vehicle in Tolo Harbour. This problem now requires a joint approach with China authorities. This may add difficulties in alleviating air pollution in Hong Kong.

The legislative measures are usually doing less than inadequate. Punishment is too lenient and cost is too high for changing and thus people are conservative about

[58] Legislative Council, Panel on Environmental Affairs, *op. cti.*
[59] So, T.W., 1993. *op. cti.,* p. 34
[60] *Ibid.,* p. 77. It is estimated that the capital cost is about $700,000.

the new proposal of air pollution. Examples can be cited in the case of petrol switching policy and the policy towards LPG taxi.

The public therefore must do something to cope with air pollution. Individuals like us, perhaps can also take some actions to alleviate air pollution in our daily life, such as to make maximum use of mass public transport, maintain your car engine, switch off idling engines, switch off domestic appliances, use energy efficient domestic appliances, use non-aerosol consumer products, use clean technology, use water-based paint, use low solvent degreasers[61] etc. Public should be cooperative and initiative to alleviate air pollution in Hong Kong.

It seems that the inadequacy of the government and reluctance of the public are the major cause for the ineffectiveness of air pollution alleviation in Hong Kong. The government should provide more financial assistant to the individuals and organizations affected to ease their opposition. And the government should be more responsive to the new problems of air pollution. As the Chief Executive of Hong Kong SAR announced in his policy address to put forward environmental protection, only the public be supportive will the air pollution of Hong Kong be alleviated.

[61] http://www.info.gov.hk/epd/air/road.htm

References:

A proposal to introduce LPG taxis: A consultation paper, 1998. Hong Kong Printing Department

Action against environmental pollution, http://www.info.gov.hk/info/pollut.htm

Air Quality Objectives, http://www.info.gov.hk/epd/E/ehk99/home/english/ch2/p46.htm

Chan, S. F., 1995. *Application of Cluster Analysis to identify sources of particulate matter in Hong Kong.* The University of Hong Kong

Clean air for Hong Kong, 1999. Hong Kong Bureau

Clean Air: Further proposals to reduce emissions from diesel vehicles: Consultation proposal, 1995. Hong Kong Government Printer

Development of New Air Legislation, http://www.info.gov.hk/epd/E/ehk99/home/english/ch2/p57.htm

Hong Kong: Department of Community Medicine, 1998. *The Health of Hong Kong Police: Finding from a health survey in traffic, foot patrol and marine police, with special reference to respiratory health, smoking exposure to environmental tobacco smoke and ambient air pollution.* The University of Hong Kong

Hong Kong: Committee in Air Pollution, 1970. *A Report on Air Pollution in Hong Kong.* Hong Kong Government Printer

http://www.info.gov.hk/edp/air/howpollute.htm

http://www.info.gov.hk/epd/air/road.htm

http://www.info.gov.hk/epd/air/programme.htm

http://www.info.gov.hk/epd/air/polsource.htm

Lam, A., *A cloudy view for the region.* http://www.info.gov.hk/edp/E/ehk99/home/english/ch2/p38.htm

Legislation for Management of Air, http://www.info.gov.hk/edp/E/chk99/home/english/ch2/p54.htm

Legislative Council, Panel on Environmental Affairs, *Control of Indoor Air Pollution.* http://www.info.gov.hk/edp/E/iaq/ea_pane1/ea2_eng.htm

Ming Pao, 2nd October 1999

Ming Pao, 9th October 1999

Mok, W.C., *LPG taxis get green light.* http://www.info.gov.hk/epd/E/ehk99/home/english/ch2/p40.htm

Petition to the governor on air pollution and health, 1995. Hong Kong: Friends of the Earth

So, T.W., 1993. *Odour Nuisance from restaurants and its control.* The University of Hong Kong

South China Morning Post, 7th October 1999

Steinbrecher, N., 1997. *Sustainable transport for Hong Kong*

Sun, S., 1995. *The feasibility study of switching from the diesel to petrol light road transport to improve the urban air quality in Hong Kong.* The University of Hong Kong

Testing the health of smoky vehicles, http://www.info.gov.hk/epd/E/ehk99/home/english/ch2/p42.htm

Thrower, S.L., 1979. *Report on the results of clean air and lichens projects, 1979*

Tong, W.F., 1997. *A Study of Suspended Airborne Particulates monitoring in Hong Kong,* The University of Hong Kong