Legislative Council
Panel on the Environment
1st October 2011

Dear Sir,
Particulate matter is one of the most lethal constituents in our polluted air. PM2.5 Particulate matter with a diameter of 2.5 microns or less remains suspended in our air and as such is known as Respirable Suspended Particulates (RSP). RSP attaches itself to ozone, and creates the brown opaque 'Haze' and - kills people.

So how bad is the PM2.5 in Hong Kong's air ?
In 2006 our Chief Executive made the following statements :
http://www.hkjournal.org/archive/2006_summer/tsang.html

> **Q.** One thing that seems to of growing concern is bad air, the environment. Do you have plans to come to grips with this?
>
> **A.** We have. **In fact, the air is not all that bad**. In fact, the air this year is better than it was last year, and last year was better than the year before. **The air quality today is not inferior to Washington, DC**, if I may say so. [Ed. note: By most measures, Hong Kong air is significantly more polluted than that of Los Angeles, which has the worst air quality of any major U.S. city.] But I'm really not complacent, and I know there is a lot of work to do. Not only in Hong Kong—in Hong Kong we have limitations on what we can do. **We have now cleaned up our old vehicular fleet.**

THE TRUTH
In 2005 when Tsang took office the Central Roadside PM2.5 level (HK EPD) was **48 micrograms per cubic meter of air** (48 µg/m3). In Washington DC the PM2.5 level is **10.7 micrograms per cubic meter** (10.7 µg/m3) which is 4 ½ times less than Hong Kong. Singapore is 19 µg/m3 even though affected every year by serious trans boundary pollution from fires burning in Borneo.

EUROPEAN AND USA STANDARDS FOR PM2.5
The current European Community annual target level for PM2.5 is **25 µg/m3**, legally binding in 2015 and their 3 year (2013/4/5) legal level is **20 µg/m3** as of 2015.
The USA National Ambient Air Quality Standards legal PM2.5 level is even stricter at **15 µg/m3.**

NO PM2.5 MONITORING IN MOST POLLUTED AREAS
We note that the HK EPD has for reasons best known to themselves chosen not to monitor PM2.5 roadside levels in our two worst locations , Mongkok and Causeway Bay and we must thereby presume that the levels are actually off the chart and higher than Central roadside levels.
http://www.hkjournal.org/archive/2006_summer/tsang.html

> **Q.** I understand that the [World Health Organization] is going to change its guidelines on air quality, and the gap will grow between the pollution levels of Hong Kong and what the WHO advises for health reasons.
>
> **A.** Well, I'm sure we are going to meet whatever standards they put up. By Asian standards, we are not bad at all

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The WHO has last month, issued a lengthy list of world cities showing the monitoring of PM2.5 and PM10.

http://www.who.int/mediacentre/news/releases/2011/air_pollution_20110926/en/index.html

WHO - Tackling the global clean air challenge

The link to the database of 1,000+ cities surveyed may be downloaded in full here:
http://www.who.int/phe/health_topics/outdoorair/databases/en/index.html

Clear the Air has made an abbreviated spreadsheet shown below which includes local PM2.5 data (source HK EPD) so Hon Members can easily compare 100 different world cities to Hong Kong.

Annual mean PM2.5 (Particulate matter with diameter of 2.5 µm or less), by city				
Region	**Country**	**City**	**Annual mean PM2.5**	**Year**
AmrHI	**Canada**	**Whitehorse**	**1.7**	**2008**
AmrHI	Canada	Victoria	4.0	2008
AmrHI	Canada	**Metro Vancouver**	**4.9**	**2008**
WprHI	Australia	**Sydney**	7.0	2009
WprHI	Australia	Hobart : New Town	7.1	2009
WprHI	Australia	Launceston (Ti Tree bend)	7.5	2009
WprHI	Australia	Port Phillip	7.7	2009
WprHI	Australia	Perth Region	8.0	2009
EurHI	Norway	Stavanger	8.1	2008
WprHI	Australia	Adelaide	8.1	2009
WprHI	Australia	Darwin	8.3	2009
WprHI	Australia	Gladstone	9.2	2009
AmrHI	United States of America	**Washington-Arlington-Alexandria, DC-VA-MD-WV**	**10.7**	**2009**
AmrHI	United States of America	**Washington-Arlington-Alexandria, DC-VA-MD-WV**	**10.7**	**2009**
WprHI	Australia	Brisbane	10.9	2009
AmrHI	Canada	Montréal	11.2	2008
EurHI	Sweden	Malmö	11.2	2008
EurHI	Spain	Madrid	13.1	2008
EurHI	Czech Republic	Kladno	13.5	2008
EurHI	**United Kingdom**	**London**	**13.5**	2008
EurHI	Germany	Karlsruhe	13.9	2008
EurHI	Denmark	Århus	13.9	2008
EurHI	France	Toulouse	13.9	2008
EurHI	Switzerland	Zürich	14.7	2008

AmrHI	United States of America	**Los Angeles-Long Beach-Glendale, CA**	14.8	2009
AmrHI	United States of America	**Los Angeles-Long Beach-Santa Ana, CA**	14.8	2009
USA	US NAAQS	US PM2.5 STANDARD	**15 ug/m3**	2010
EurHI	Germany	Hannover	15.4	2008
EurHI	Germany	Stuttgart	15.5	2008
EurHI	Germany	Frankfurt am Main	16.3	2008
EurHI	Austria	Salzburg	16.7	2008
EurHI	Czech Republic	Jihlava	16.9	2008
EurHI	Denmark	Aalborg	16.9	2008
EurHI	Netherlands	Breda	17.6	2008
EurHI	France	Le Havre	17.7	2008
EurHI	Netherlands	**Rotterdam**	17.9	2008
AmrLMI	Chile	Valparaiso	18.7	2007
EurHI	Belgium	Bruxelles / Brussel	18.7	2008
WprHI	**Singapore**	**Singapore**	**19.0**	**2009**
AmrLMI	Ecuador	Quito	19.4	2009
EurLMI	Latvia	Riga	19.4	2008
EurHI	Italy	Rimini	19.5	2008
EurHI	Germany	Berlin	20.8	2008
WprLMI	**Philippines**	**Metro Manila**	21.0	2007
EurLMI	Poland	Wroclaw	21.5	2008
AmrLMI	Mexico	Zona Met de Guadalajara	22.4	2009
EurHI	**France**	**Paris**	**22.9**	**2008**
Afr	Tanzania	Dar es Salaam	23.0	2005-2006
EurHI	Austria	Graz	23.8	2008
AmrLMI	Chile	Concepcion	24.0	2007
AmrLMI	Mexico	Zona Met del Valle de Mexico	24.4	2009
EU	**BECOMES LAW 1/1/2015**	**EU TARGET STANDARD FOR PM2.5 (ANNUAL)**	**25 ug/m3**	**2010**
EU		**EU LEGAL STANDARD FOR PM2.5 (3 YR AVG)**	**20 ug/m3**	**2015**
HKEPD	**HONG KONG**	**TAP MUN**	**26.0**	**2010**
EurHI	Greece	Athens	27.4	2008
EurHI	Czech Republic	Ostrava	27.4	2008
HKEPD	**HONG KONG**	**TAP MUN**	**28.0**	**2009**
HKEPD	**HONG KONG**	**TUNG CHUNG**	**29.0**	**2010**
HKEPD	**HONG KONG**	**TUNG CHUNG**	**30.0**	**2009**
HKEPD	**HONG KONG**	**TSUEN WAN**	**30.0**	**2010**
EmrLMI	**Lebanon**	**Beirut**	**31.0**	**2004**
EurHI	**Italy**	**Brescia**	**31.1**	**2008**
EurHI	**Italy**	**Milano**	**31.7**	**2008**
AmrLMI	**Chile**	**Santiago**	**31.7**	**2006**
HKEPD	**HONG KONG**	**TSUEN WAN**	**32.0**	**2009**
HKEPD	**HONG KONG**	**YUEN LONG**	**32.0**	**2010**

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AmrLMI	Chile	Talca	32.8	2007
HKEPD	HONG KONG	YUEN LONG	33.0	2009
HKEPD	HONG KONG	TAP MUN	34.0	2006
AmrLMI	Peru	Lima	34.2	2010
EurHI	Italy	Torino	34.4	2008
HKEPD	HONG KONG	TAP MUN	35.0	2008
HKEPD	HONG KONG	CENTRAL ROADSIDE	35.0	2009
EurLMI	Poland	Kraków	35.5	2008
HKEPD	HONG KONG	CENTRAL ROADSIDE	36.0	2010
HKEPD	HONG KONG	TSUEN WAN	37.0	2008
HKEPD	HONG KONG	TUNG CHUNG	37.0	2008
Afr	Senegal	Dakar	38.0	2010
HKEPD	HONG KONG	TAP MUN	38.0	2005
HKEPD	HONG KONG	TAP MUN	38.0	2007
HKEPD	HONG KONG	TUNG CHUNG	39.0	2007
HKEPD	HONG KONG	TUNG CHUNG	40.0	2005
HKEPD	HONG KONG	TUNG CHUNG	40.0	2006
EurLMI	Poland	Zabrze	40.4	2008
HKEPD	HONG KONG	TSUEN WAN	41.0	2006
HKEPD	HONG KONG	TSUEN WAN	41.0	2007
HKEPD	HONG KONG	YUEN LONG	41.0	2008
HKEPD	HONG KONG	CENTRAL ROADSIDE	41.0	2008
HKEPD	HONG KONG	YUEN LONG	42.0	2005
HKEPD	HONG KONG	TSUEN WAN	43.0	2005
HKEPD	HONG KONG	YUEN LONG	43.0	2006
HKEPD	HONG KONG	YUEN LONG	43.0	2007
HKEPD	HONG KONG	CENTRAL ROADSIDE	45.0	2007
HKEPD	HONG KONG	CENTRAL ROADSIDE	47.0	2006
HKEPD	HONG KONG	CENTRAL ROADSIDE	48.0	2005
Afr	Ghana	Accra	49.8	2008
AmrLMI	Mexico	Mexicali	51.0	2008
EmrHI	Kuwait	Kuwait City	51.0	2004
Afr	Madagascar	Antananarivo	59.0	2003
WprLMI	Mongolia	Ulaanbaatar	63.0	2008
			ug/m3	

Particulate Matter http://www.bcairquality.ca/health/air-quality-and-health.html

At current levels, **particulate matter is the most serious kind of local air pollution** in the province. **It poses more danger to human health than ground-level ozone (in smog), and other common air pollutants like carbon monoxide.**
From our lungs' point of view, bigger particulates are less harmful. Because of their weight, the larger particulate matter — between 10 and 2.5 microns in diameter (PM_{10}) — settles to the ground quickly. If we do inhale it, this particulate matter collects in our nose and throat. Then our body eliminates it through such processes as sneezing and coughing.
In contrast, particulate matter that's less than 2.5 microns in diameter ($PM_{2.5}$) can remain in the air for days to weeks. It can penetrate deep into our lungs, collecting in tiny air sacs (alveoli) where oxygen enters the bloodstream. Health problems begin when the body starts to react to these foreign invaders. Another danger is that $PM_{2.5}$ can contain a number of potentially harmful substances, such as cancer-causing chemicals.
Coughing and wheezing are two of the mild problems associated with inhaling $PM_{2.5}$. However, this type of air pollution can also cause or worsen serious illnesses such as asthma, heart disease, chronic bronchitis, emphysema and pneumonia. **Exposure to $PM_{2.5}$ is associated with a significant rise in the number of premature deaths from respiratory and heart disease.** It's also linked with more emergency room visits, hospitalization, and time off work and school. Long-term exposure in pregnant women can cause premature births and low birth weights. Senior citizens, infants, and people who already have lung, heart and other illnesses (such as diabetes) are the most vulnerable. However, healthy adults and children can be affected, too.
$PM_{2.5}$ and asthma are a bad mix. $PM_{2.5}$ can increase the number of asthma attacks, and make them more severe. Over 1.2 million Canadians suffer from this condition, and asthma is the most common cause of medical emergencies in children.
A 2002-3 BC Lung Association study of air quality in the Lower Fraser Valley found that even low amounts of $PM_{2.5}$ in the air can harm our health. In fact, the study pointed out that a safe level of $PM_{2.5}$ (below which there are no health impacts) has not been found. As $PM_{2.5}$ increases, so do the health problems. Long-term exposure to $PM_{2.5}$ is an added health hazard.

What is $PM_{2.5}$? http://www.epa.gov/pmdesignations/faq.htm
Particulate matter, or PM, is the term for particles found in the air, including dust, dirt, soot, smoke, and liquid droplets. Particles can be suspended in the air for long periods of time. Some particles are large or dark enough to be seen as soot or smoke. Others are so small that individually they can only be detected with an electron microscope.
Many manmade and natural sources emit PM directly or emit other pollutants that react in the atmosphere to form PM. These solid and liquid particles come in a wide range of sizes. **Particles less than 10 micrometers in diameter (PM_{10}) pose a health concern because they can be inhaled into and accumulate in the respiratory system.** Particles less than 2.5 micrometers in diameter ($PM_{2.5}$) are referred to as "fine" particles and are believed to pose the greatest health risks. Because of their small size (approximately 1/30th the average width of a human hair), fine particles can lodge deeply into the lungs unhindered by nose hairs. Sources of fine particles include all types of combustion activities (motor vehicles, power plants, wood burning, etc.) and certain industrial processes. Particles with diameters

between 2.5 and 10 micrometers are referred to as "coarse." Sources of coarse particles include crushing or grinding operations, and dust from paved or unpaved roads. Other particles may be formed in the air from the chemical change of gases. They are indirectly formed when gases from burning fuels react with sunlight and water vapor. These can result from fuel combustion in motor vehicles, at power plants, and in other industrial processes

AIR QUALITY STANDARDS EUROPE

Air Quality Standards

Humans can be adversely affected by exposure to air pollutants in ambient air. In response, the European Union has developed an extensive body of legislation which establishes health based standards and objectives for a number of pollutants in air. These standards and objectives are summarised in the table below. These apply over differing periods of time because the observed health impacts associated with the various pollutants occur over different exposure times.

http://ec.europa.eu/environment/air/quality/standards.htm

Pollutant	*Concentration*	*Averaging period*	*Legal nature*	*Permitted exceedences each year*
Fine articles (PM2.5)	**25 µg/m3*** **	**1 year**	Target value entered into force 1.1.2010 Limit value enters into force 1.1.2015	n/a
Sulphur dioxide (SO2)	350 µg/m3	1 hour	Limit value entered into force 1.1.2005	24
	125 µg/m3	24 hours	Limit value entered into force 1.1.2005	3
Nitrogen dioxide (NO2)	200 µg/m3	1 hour	Limit value entered into force 1.1.2010	18
	40 µg/m3	1 year	Limit value entered into force 1.1.2010*	n/a
PM10	**50 µg/m3**	**24 hours**	Limit value entered into force 1.1.2005**	35
	40 µg/m3	**1 year**	Limit value entered into force 1.1.2005**	n/a
Lead (Pb)	0.5 µg/m3	1 year	Limit value entered into force 1.1.2005 (or 1.1.2010 in the immediate vicinity of specific, notified industrial sources; and a 1.0 µg/m3 limit value applied from 1.1.2005 to 31.12.2009)	n/a
Carbon monoxide (CO)	10 mg/m3	Maximum daily 8 hour mean	Limit value entered into force 1.1.2005	n/a
Benzene	5 µg/m3	1 year	Limit value entered into force 1.1.2010**	n/a
Ozone	120 µg/m3	Maximum daily 8 hour mean	Target value entered into force 1.1.2010	25 days averaged over 3 years
Arsenic (As)	6 ng/m3	1 year	Target value enters into force 31.12.2012	n/a

Cadmium (Cd)	5 ng/m3	1 year	Target value enters into force 31.12.2012	n/a
Nickel (Ni)	20 ng/m3	1 year	Target value enters into force 31.12.2012	n/a
Polycyclic Aromatic Hydrocarbons	1 ng/m3 (expressed as concentration of Benzo(a)pyrene)	1 year	Target value enters into force 31.12.2012	n/a

**Under the new Directive the member State can apply for an extension of up to five years (i.e. maximum up to 2015) in a specific zone. Request is subject to assessment by the Commission. . In such cases within the time extension period the limit value applies at the level of the limit value + maximum margin of tolerance (* 48 µg/m3 for annual NO2 limit value).

***Under the new Directive the Member State was able to apply for an extension until three years after the date of entry into force of the new Directive (i.e. May 2011) in a specific zone. Request was subject to assessment by the Commission. In such cases within the time extension period the limit value applies at the level of the limit value + maximum margin of tolerance (35 days at 75*µg/m3 for daily PM10 limit value, 48 µg/m3 for annual Pm10 limit value).

****Standard introduced by the new Directive.*

Under EU law a limit value is legally binding from the date it enters into force subject to any exceedances permitted by the legislation. A target value is to be attained as far as possible by the attainment date and so is less strict than a limit value.

The new Directive is introducing additional PM2.5 objectives targetting the **exposure** of the population to fine particles. These objectives are set at the national level and are based on the average exposure indicator (AEI).

AEI is determined as a 3-year running annual mean PM2.5 concentration averaged over the selected monitoring stations in agglomerations and larger urban areas, set in urban background locations to best assess the PM2.5 exposure to the general population.

Title	*Metric*	*Averaging period*	*Legal nature*	*Permitted exceedences each year*
PM2.5 Exposure concentration obligation	**20 µg/m3 (AEI)**	Based on 3 year average	**Legally binding in 2015 (years** 2013,2014,2015)	n/a
PM2.5 Exposure reduction target	Percentage reduction* + all measures to reach 18 µg/m3 (AEI)	Based on 3 year average	Reduction to be attained where possible in 2020, determined on the basis of the value of exposure indicator in 2010	n/a

**** Depending on the value of AEI in 2010, a percentage reduction requirement (0,10,15, or 20%) is set in the Directive. If AEI in 2010 is assessed to be over 22 µg/m3, all appropriate measures need to be taken to achieve 18 µg/m3 by 2020.***

Principles

European legislation on air quality is built on certain principles. The first of these is that the Member States divide their territory into a number of zones and agglomerations. In these zones and agglomerations, the Member States should undertake assessments of air pollution levels using measurements and modelling and other empirical techniques. Where levels are elevated, the Member States should prepare an air quality plan or programme to ensure compliance with the limit value before the date when the limit value formally enters into force. In addition, information on air quality should be disseminated to the public. See more under Implementation.

AIR QUALITY STANDARDS USA (NAAQS)
http://www.epa.gov/air/criteria.html

National Ambient Air Quality Standards (NAAQS)

The Clean Air Act, which was last amended in 1990, requires EPA to set **National Ambient Air Quality Standards** (40 CFR part 50) for pollutants considered harmful to public health and the environment. The Clean Air Act established two types of national air quality standards. ***Primary standards*** set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. ***Secondary standards*** set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.

The EPA Office of Air Quality Planning and Standards (OAQPS) has set National Ambient Air Quality Standards for six principal pollutants, which are called "criteria" pollutants. They are listed below. Units of measure for the standards are parts per million (ppm) by volume, parts per billion (ppb - 1 part in 1,000,000,000) by volume, milligrams per cubic meter of air (mg/m^3), and micrograms per cubic meter of air ($\mu g/m^3$).

National Ambient Air Quality Standards

	Primary Standards		Secondary Standards	
Pollutant	**Level**	**Averaging Time**	**Level**	**Averaging Time**
Carbon Monoxide	9 ppm (10 mg/m^3)	8-hour [1]	None	
	35 ppm (40 mg/m^3)	1-hour [1]		
Lead	0.15 $\mu g/m^3$ [2]	Rolling 3-Month Average	Same as Primary	
Nitrogen Dioxide	53 ppb [3]	Annual (Arithmetic Average)	Same as Primary	
	100 ppb	1-hour [4]	None	
Particulate Matter (PM_{10})	**150 $\mu g/m^3$**	**24-hour** [5]	Same as Primary	
Particulate Matter ($PM_{2.5}$)	**15.0 $\mu g/m^3$**	**Annual** [6] (Arithmetic Average)	Same as Primary	
	35 $\mu g/m^3$	24-hour [7]	Same as Primary	
Ozone	0.075 ppm (2008 std)	8-hour [8]	Same as Primary	
	0.08 ppm (1997 std)	8-hour [9]	Same as Primary	
	0.12 ppm	1-hour [10]	Same as Primary	

Sulfur Dioxide	0.03 ppm [11] (1971 std)	Annual (Arithmetic Average)	0.5 ppm	3-hour [1]
	0.14 ppm [11] (1971 std)	24-hour [1]		
	75 ppb [12]	1-hour	None	

[1] Not to be exceeded more than once per year.

[2] Final rule signed October 15, 2008. The 1978 lead standard (1.5 µg/m^3 as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

[3] The official level of the annual NO_2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard

[4] To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 100 ppb (effective January 22, 2010).

[5] Not to be exceeded more than once per year on average over 3 years.

[6] To attain this standard, the 3-year average of the weighted annual mean PM2.5 concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m^3.

[7] To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m^3 (effective December 17, 2006).

[8] To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm. (effective May 27, 2008)

[9] (a) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.

(b) The 1997 standard—and the implementation rules for that standard—will remain in place for implementation purposes as EPA undertakes rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard.

(c) EPA is in the process of reconsidering these standards (set in March 2008).

[10] (a) EPA revoked the 1-hour ozone standard in all areas, although some areas have continuing obligations under that standard ("anti-backsliding").

(b) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is $\leq$ 1.

[11] The 1971 sulfur dioxide standards remain in effect until one year after an area is designated for the 2010 standard, except that in areas designated nonattainment for the 1971 standards, the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standards are approved.

[12] Final rule signed June 2, 2010. To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppb.

http://whqlibdoc.who.int/hq/2006/WHO_SDE_PHE_OEH_06.02_eng.pdf

WHO Air Quality Guidelines and their rationale

Particulate matter

Guidelines

$PM_{2.5}$: 10 μg/m3 annual mean
25 μg/m3 24-hour mean

PM_{10}:
20 μg/m3 annual mean
50 μg/m3 24-hour mean

We urge members of Legco to impress on the Administration:

- the need for additional roadside monitoring stations in Mongkok , Causeway Bay and elsewhere in Hong Kong to reveal the true extent of this PM2.5 pollutant
- the urgency of preventative action instead of continued Government prevarication.
- the need to impose an Emissions Control Area within Hong Kong waters to force shipping to use low sulphur fuel
- the forced immediate retirement of diesel vehicles which are less than Euro III standard and inclusion of immediate Best Available Current Technology in any bus franchise renewals (no allowance to use old buses under new Franchises).
- the need for peer monitored environmental impact assessments on any major planned infrastructure projects.

Yours faithfully,

James Middleton

Chairman
Clear the Air NGO and Charity

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