

2013 Hong Kong Emission Inventory Report

Report Number : EPD/TR 2/14
Report Prepared by : Zues Wan, Simon Lam, Ray Leung
Work Done by : Air Science Group
Checked by : Cathy Lee
Approved by : Shermann Fong
Security Classification : Unrestricted

Air Science Group

•
Environmental Protection Department

•
**The Government of the Hong Kong
Special Administrative Region**

June 2015

CONTENT

1	INTRODUCTION	1
2	SCOPE OF EMISSION INVENTORY	1
3	2013 EMISSION INVENTORY	1
4	EMISSION TRENDS FROM 1997 TO 2013	6
5	SECTORAL ANALYSES.....	12
6	EMISSION REDUCTION PLAN UP TO 2020	18

Annexes

Annex 1 – Breakdown of Emission Inventory by Source Category from 2012 to 2013

Annex 2 – Summary of Updates to the Emission Inventory

**Annex 3 – Comparison between the Previous and Recalculated Inventories from
1997 to 2012**

Annex 4 – Emission Reduction Targets/Ranges up to 2020

1 INTRODUCTION

1.1 The Environmental Protection Department (EPD) compiles the Hong Kong Air Pollutant Emission Inventory every year to analyze the air pollution condition and the major emission sources which helps formulate the air quality management strategy in Hong Kong. The emission inventory for Hong Kong was first uploaded to EPD's website in March 2000.

1.2 This report presents the 2013 Hong Kong Emission Inventory. It describes:

- (i) the emission inventory by source category in 2013 (Chapter 3);
- (ii) the emission trends from 1997 to 2013 for six major air pollutants (Chapter 4);
- (iii) the sectoral analyses for six emission source categories (Chapter 5); and
- (iv) the emission reduction plan up to 2020 (Chapter 6).

2 SCOPE OF EMISSION INVENTORY

2.1 The emission inventory comprises estimates of the emissions from six source categories for six major air pollutants, namely: sulphur dioxide (SO₂), nitrogen oxides (NO_x), respirable suspended particulates (RSP or PM₁₀), fine suspended particulates (FSP or PM_{2.5}), volatile organic compounds (VOC), and carbon monoxide (CO). The emission sources include power electricity generation, road transport, navigation, civil aviation, other fuel combustion sources and non-combustion sources.

2.2 Other fuel combustion sources are defined as sources involving combustion of fuels, other than power electricity generation, road transport, navigation and civil aviation. Major contributing sources in this sector include non-road mobile machineries operating in construction sites and container terminals.

2.3 Non-combustion sources are defined as those remaining sources that do not involve combustion of fuels and only VOC, RSP and FSP emissions are significant. Under this category, the major sources for VOC include paints and associated solvents, consumer products and printing, whereas those for RSP and FSP include paved road dust, construction dust, quarry production and cooking fume.

3 2013 EMISSION INVENTORY

3.1 The table below shows the breakdown of air pollutant emissions by source category in 2013, while **Annex 1** shows the changes in emissions between 2012 and 2013.

Breakdown of 2013 Emission Inventory

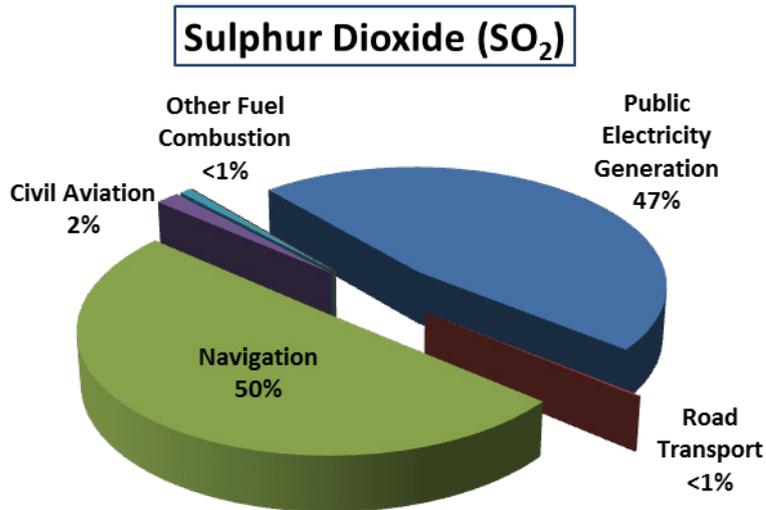
Pollution Sources	Emissions (Tonnes)					
	SO₂	NO_x	RSP	FSP	VOC	CO
Public Electricity Generation	14,680	34,580	940	430	460	3,930
Road Transport	50	25,740	1,090	1,000	6,650	35,840
Navigation	15,740	35,630	2,160	2,000	3,360	11,670
Civil Aviation	540	6,240	60	60	580	3,320
Other Fuel Combustion	280	11,040	850	780	1,170	6,040
Non-combustion	N/A	N/A	950	480	17,200	N/A
Total Emissions	31,280	113,220	6,040	4,740	29,420	60,790

Note: - All figures are rounded to the nearest ten.
- "N/A" denotes not applicable.
- There may be slight discrepancies between the sums of individual items and the total emissions shown in the table because of rounding.

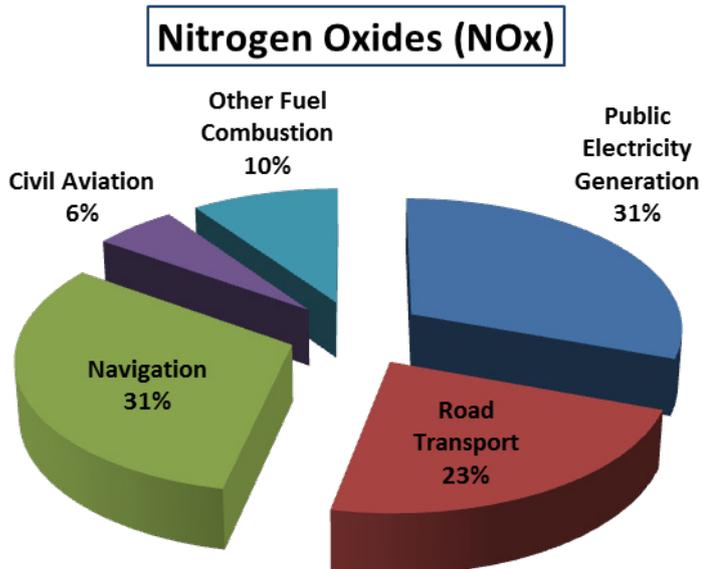
3.2 A summary of updates to the emission inventories is appended at **Annex 2**.

3.3 The following pie charts show the percentage share of emissions by source category for each pollutant in 2013.

Total SO₂ emission = 31,280 Tonnes

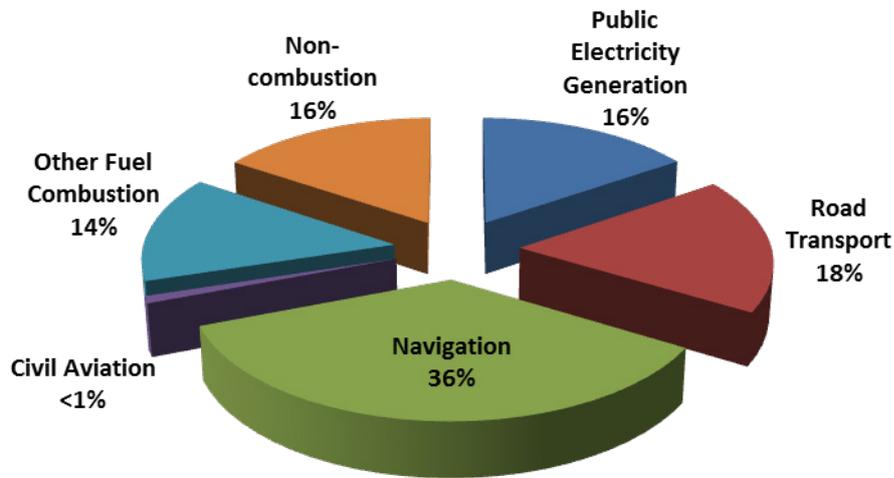


Total NO_x emission = 113,220 Tonnes



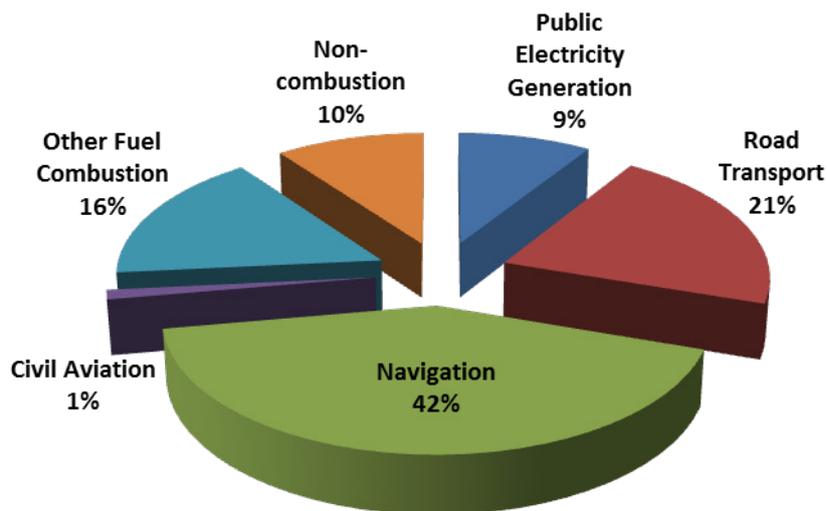
Total RSP emission = 6,040 Tonnes

Respirable Suspended Particulates (RSP)



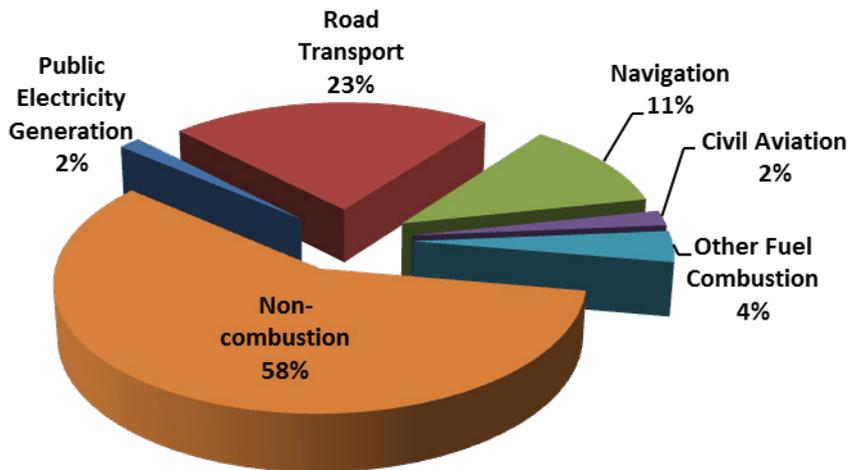
Total FSP emission = 4,740 Tonnes

Fine Suspended Particulates (FSP)



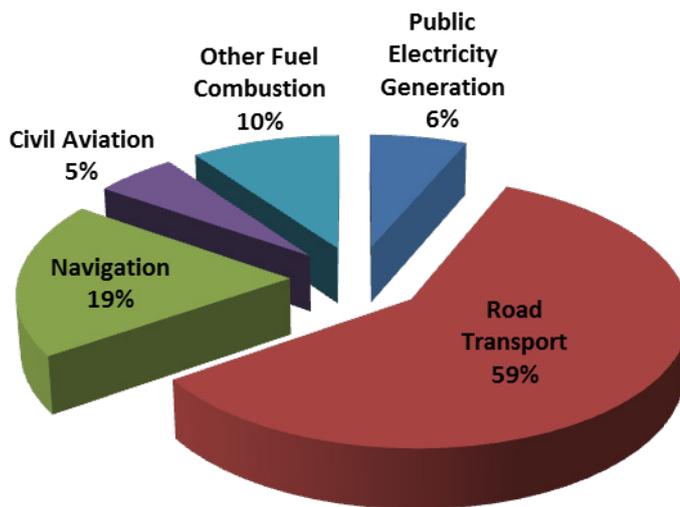
Total VOC emission = 29,420 Tonnes

Volatile Organic Compounds (VOC)



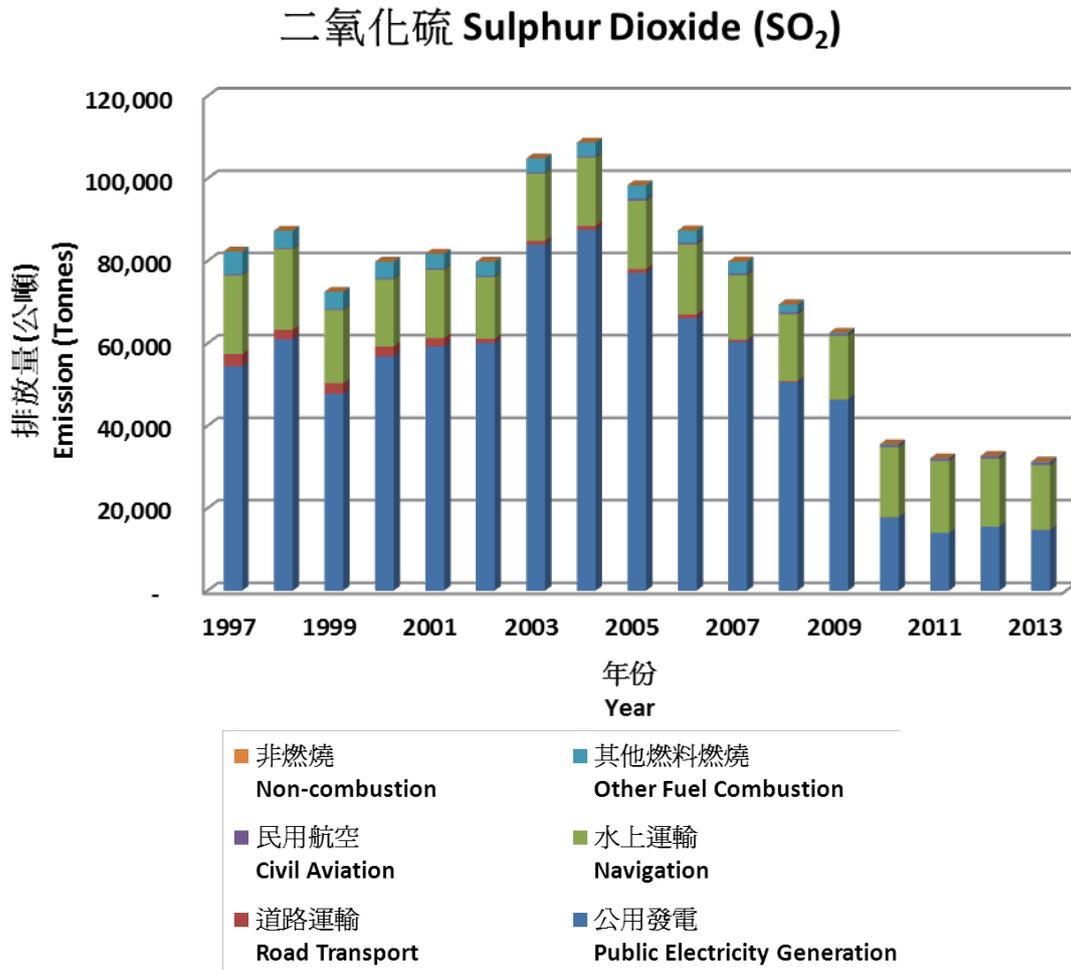
Total CO emission = 60,790 Tonnes

Carbon Monoxide (CO)



4 EMISSION TRENDS FROM 1997 TO 2013

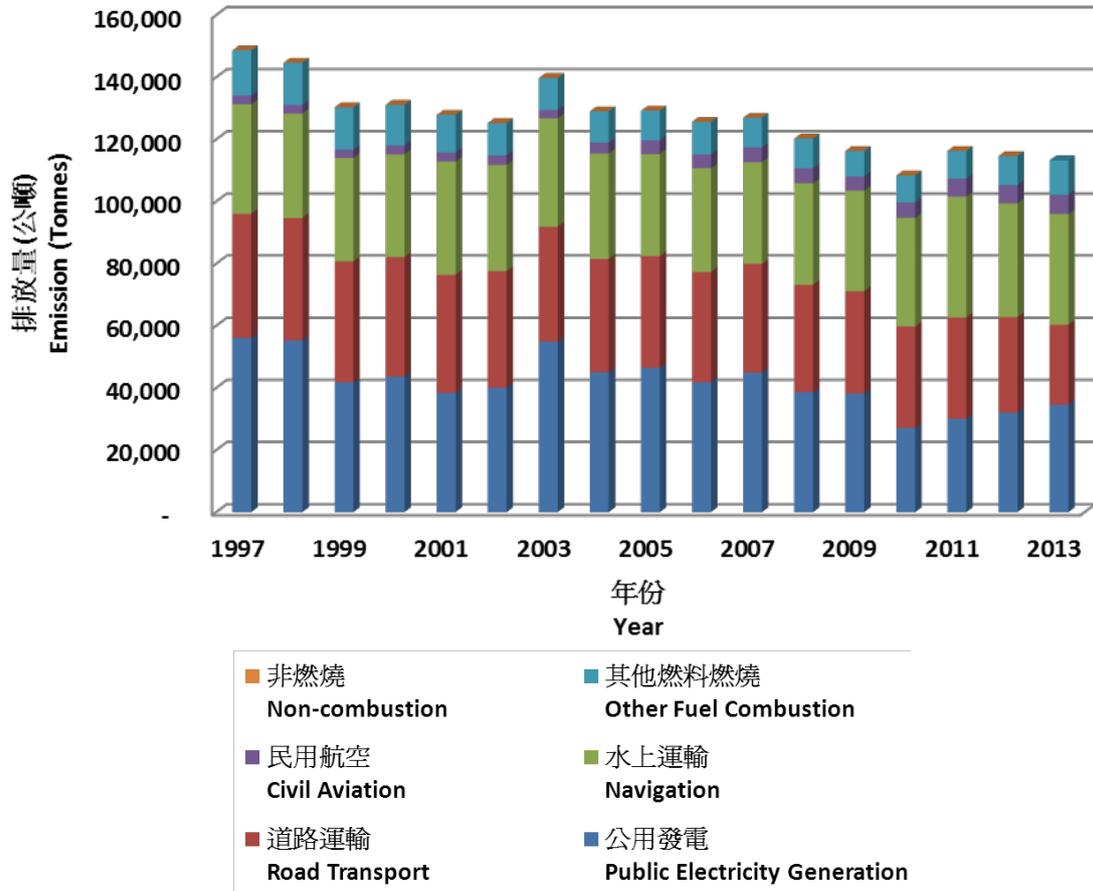
SO₂ Emission Trend



4.1 Between 1997 and 2013, SO₂ emissions decreased by 62% which was mainly caused by the decline in emissions from the public electricity generation sector. Navigation and public electricity generation sectors were the top two sources of SO₂ emissions, accounting for 50% and 47% of total SO₂ emissions in 2013, respectively.

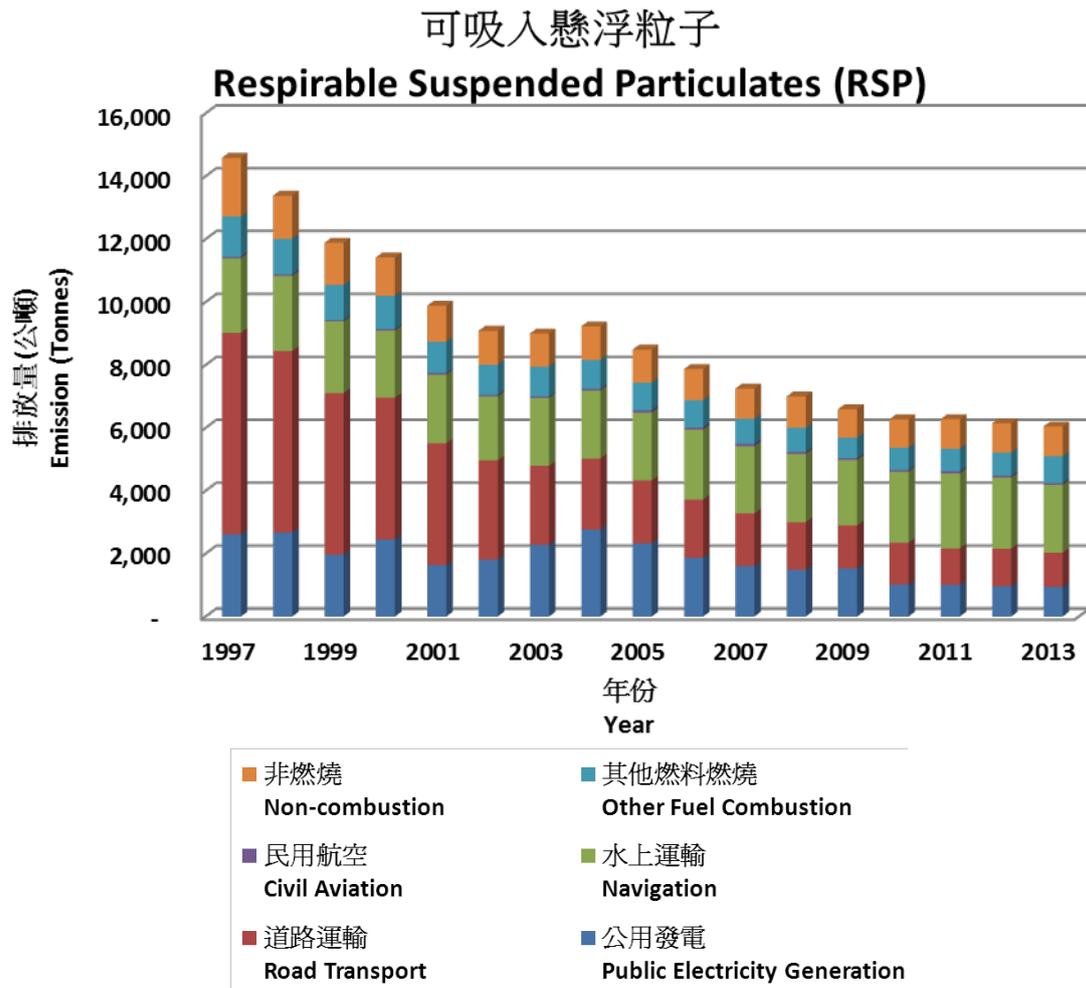
NOx Emission Trend

氮氧化物 Nitrogen Oxides (NOx)



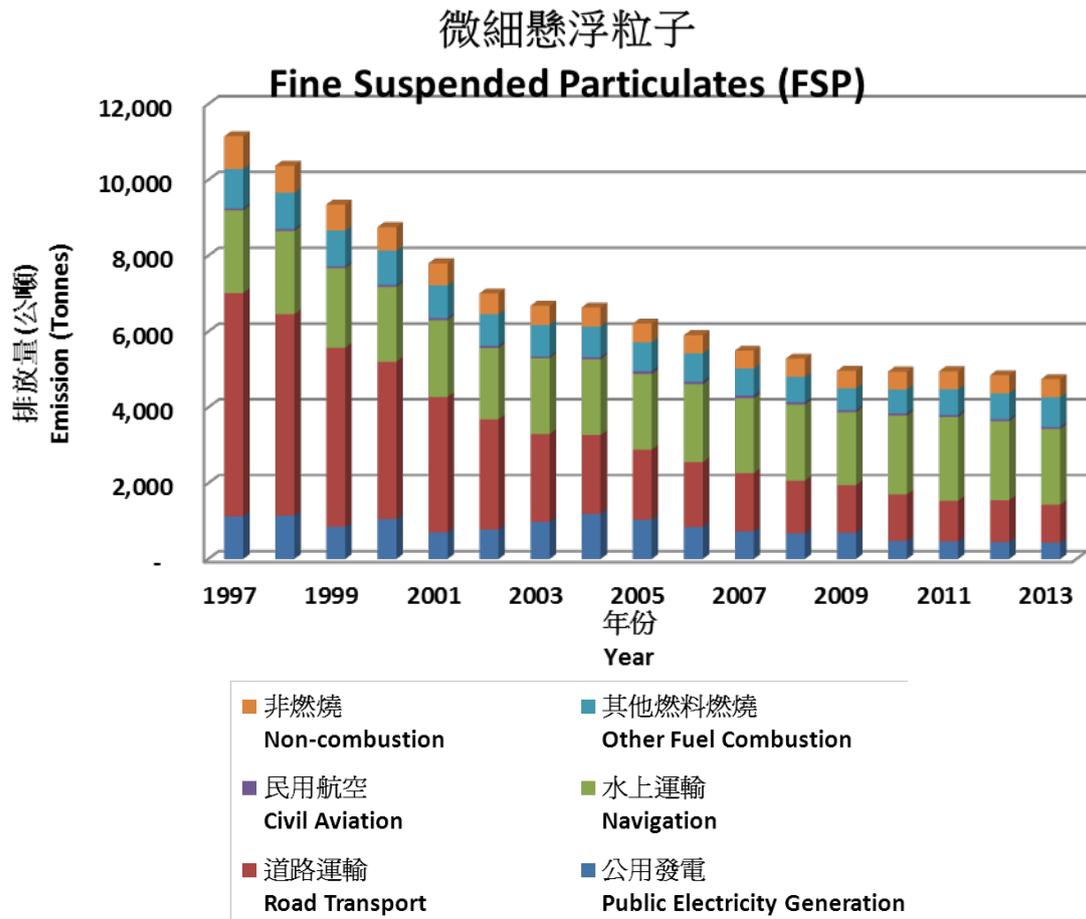
4.2 Between 1997 and 2013, NOx emissions decreased by 24%. Navigation, public electricity generation and road transport sectors were the top three sources of NOx emissions, accounting for 31%, 31% and 23% of total NOx emissions in 2013, respectively.

RSP Emission Trend



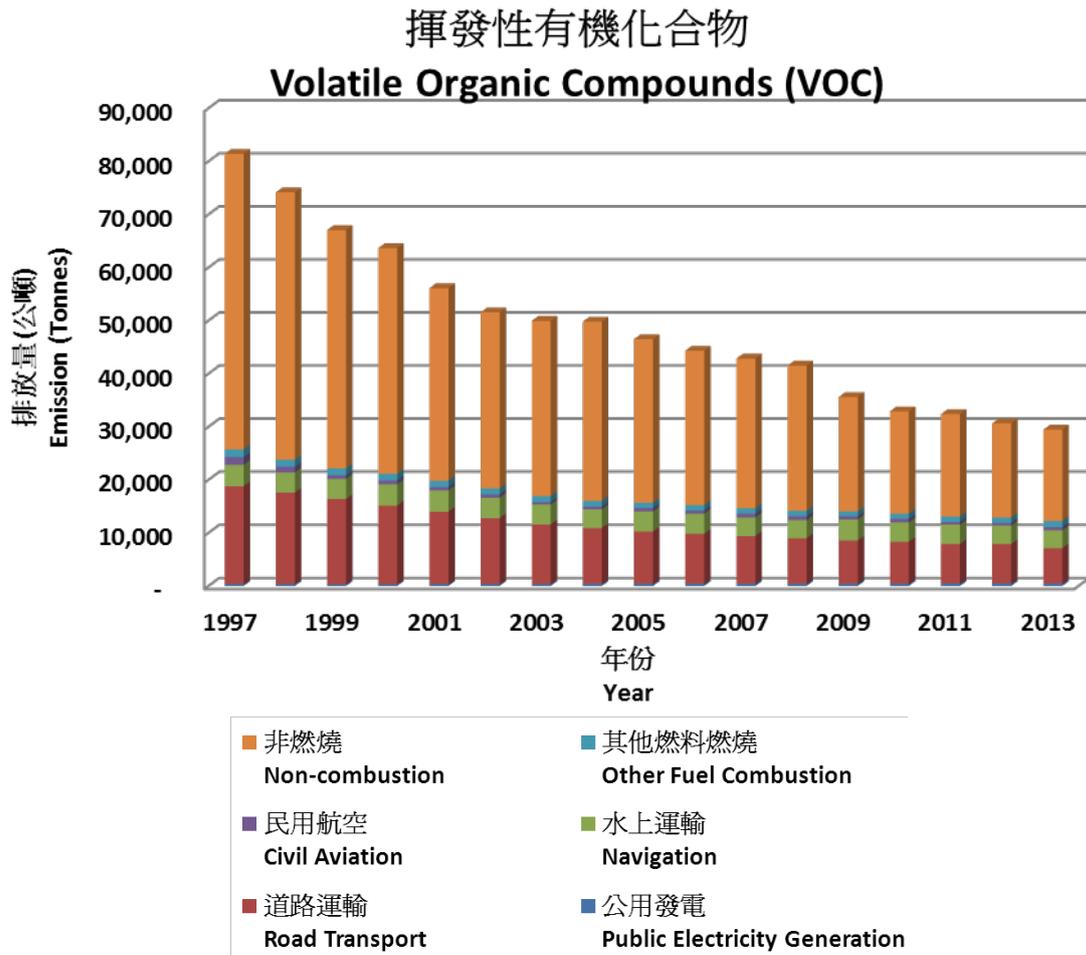
4.3 Between 1997 and 2013, RSP emissions decreased by 59% which was mainly caused by the decline in emissions from the road transport and public electricity generation sectors. Navigation, road transport and non-combustion sectors were the top three sources of RSP emissions, accounting for 36%, 18% and 16% of total RSP emissions in 2013, respectively.

FSP Emission Trend



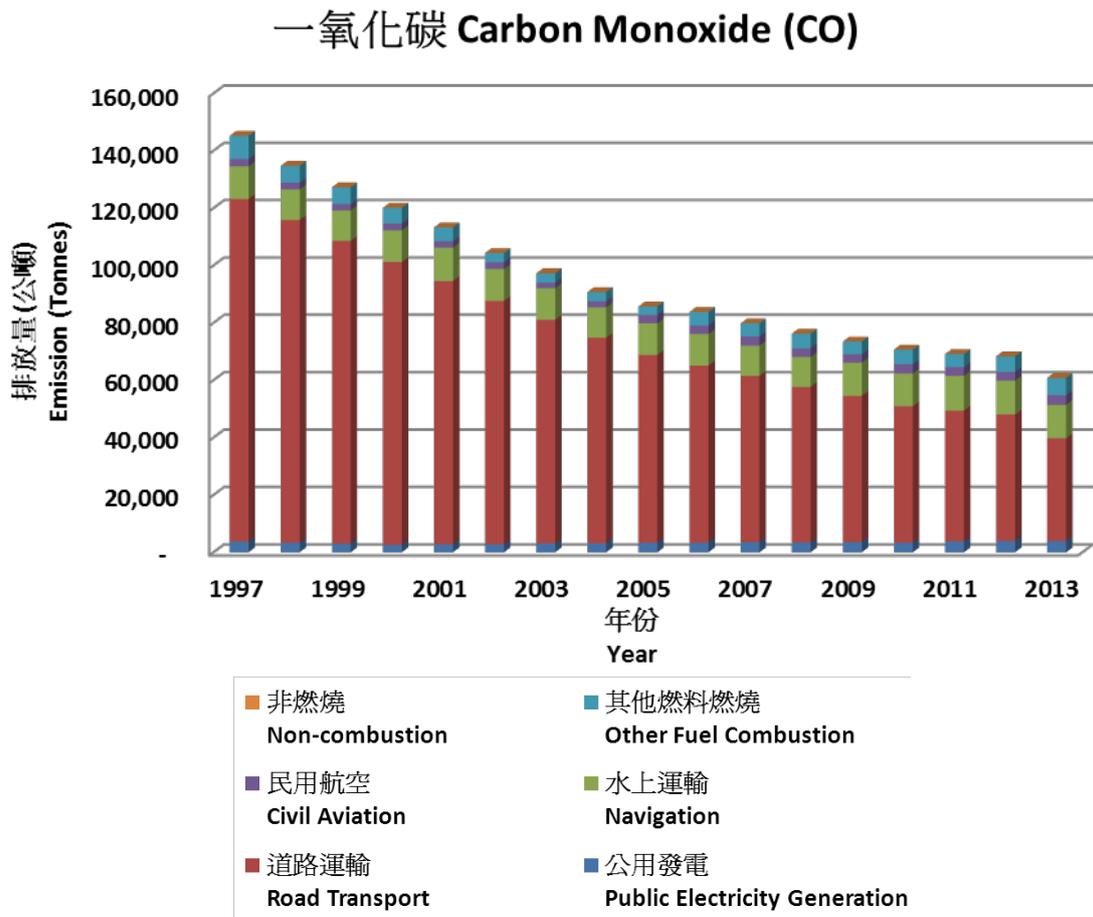
4.4 As FSP is a fraction of RSP, they share similar emission sources and emission trends. Between 1997 and 2013, FSP emissions decreased by 57%. Navigation, road transport and other fuel combustion sectors were the top three sources of FSP emissions, accounting for 42%, 21% and 16% of total FSP emissions in 2013, respectively.

VOC Emission Trend



4.5 Between 1997 and 2013, VOC emissions decreased by 64% which was mainly due to the decline in emissions from non-combustion and road transport sectors. Non-combustion and road transport sectors were the top two sources of VOC emissions, accounting for 58% and 23% of total VOC emissions in 2013, respectively.

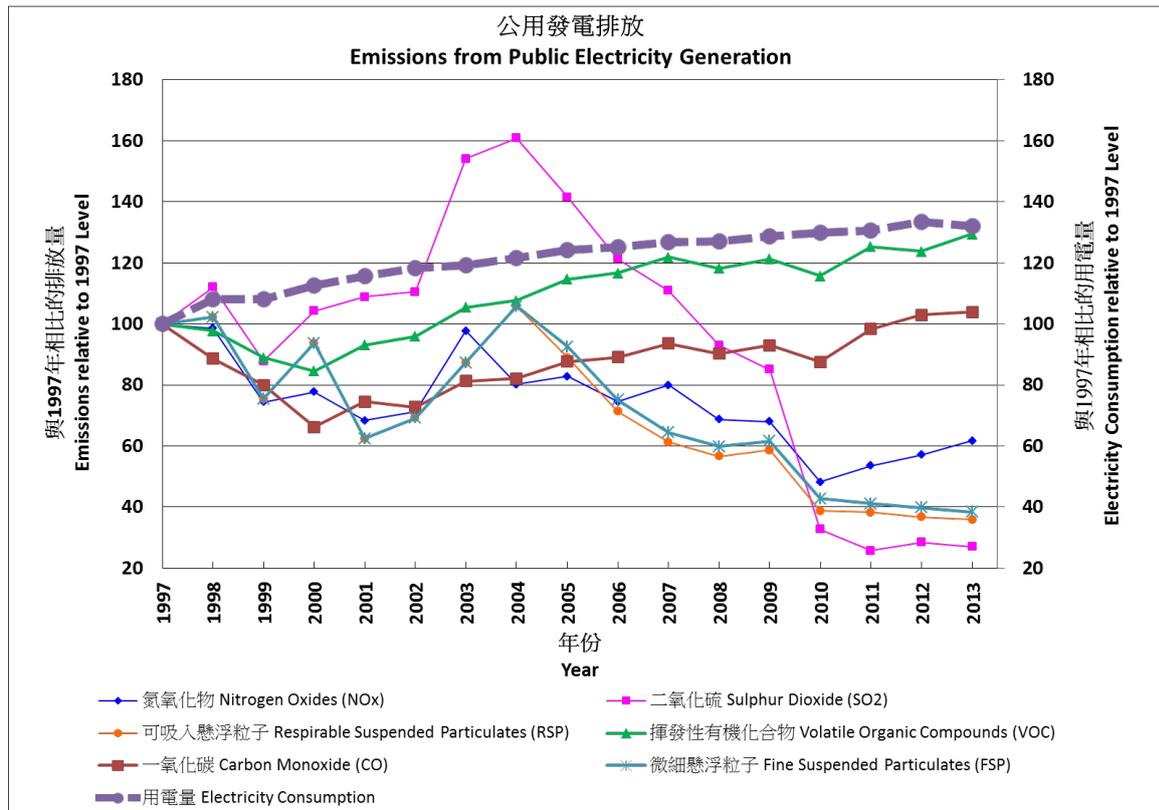
CO Emission Trend



4.6 Between 1997 and 2013, CO emissions decreased by 58% which was mainly due to the decline in emissions from the road transport sector. Among the six emission source categories, road transport was the major CO emitter, accounting for 59% of total CO emissions in 2013.

5 SECTORAL ANALYSES

Sectoral analysis for “Public electricity generation”

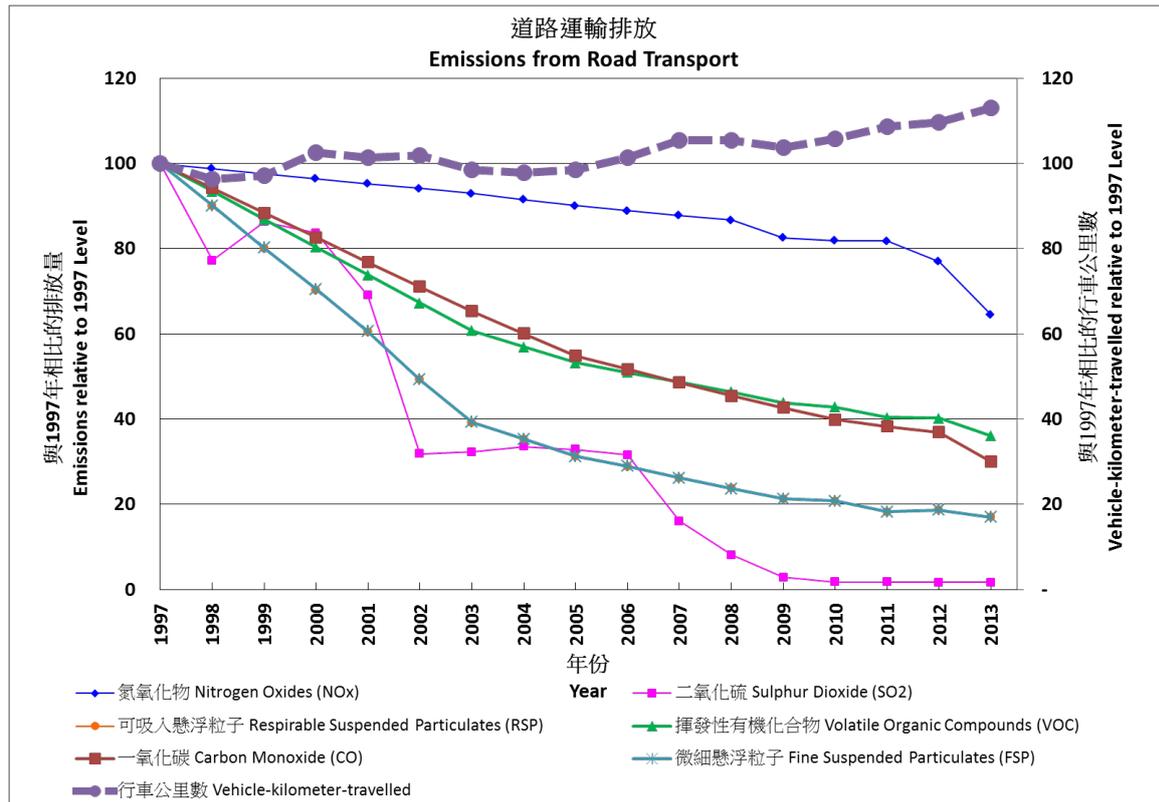


5.1 Power sector had been a major contributor to SO₂, NO_x and RSP emissions. Subsequent to the imposition of statutory emission caps on power plants, its SO₂ emissions reduced substantially by 73%; NO_x emissions by 38% and RSP emissions by 64% from 1997 to 2013, despite an increase of electricity consumption of 32%. In 2013, the emissions of SO₂, NO_x and RSP accounted for 47%, 31% and 16% of the total emissions respectively.

5.2 That said, the emissions of NO_x, CO and VOC showed gentle rising trends from 2010 to 2013 due to the increased use of coal during the period.

5.3 The EPD has progressively tightened the emission caps since 2005. In 2008, we stipulated the stringent emission caps for 2010 and beyond through the first Technical Memorandum (TM) for power plants. Three more TMs were issued in 2010, 2012 and 2014 to further tighten the emission caps starting in 2015, 2017 and 2019 respectively. By 2019, the emission caps of SO₂, NO_x and RSP would be reduced by 63%, 40% and 44% respectively, compared to the emission caps for 2010. In order to meet the emission caps, power companies have to switch to clean fuel including natural gas and low emission coal, and prioritize the use of coal-fired generation units equipped with advanced emission control equipment.

Sectoral analysis for “Road transport”

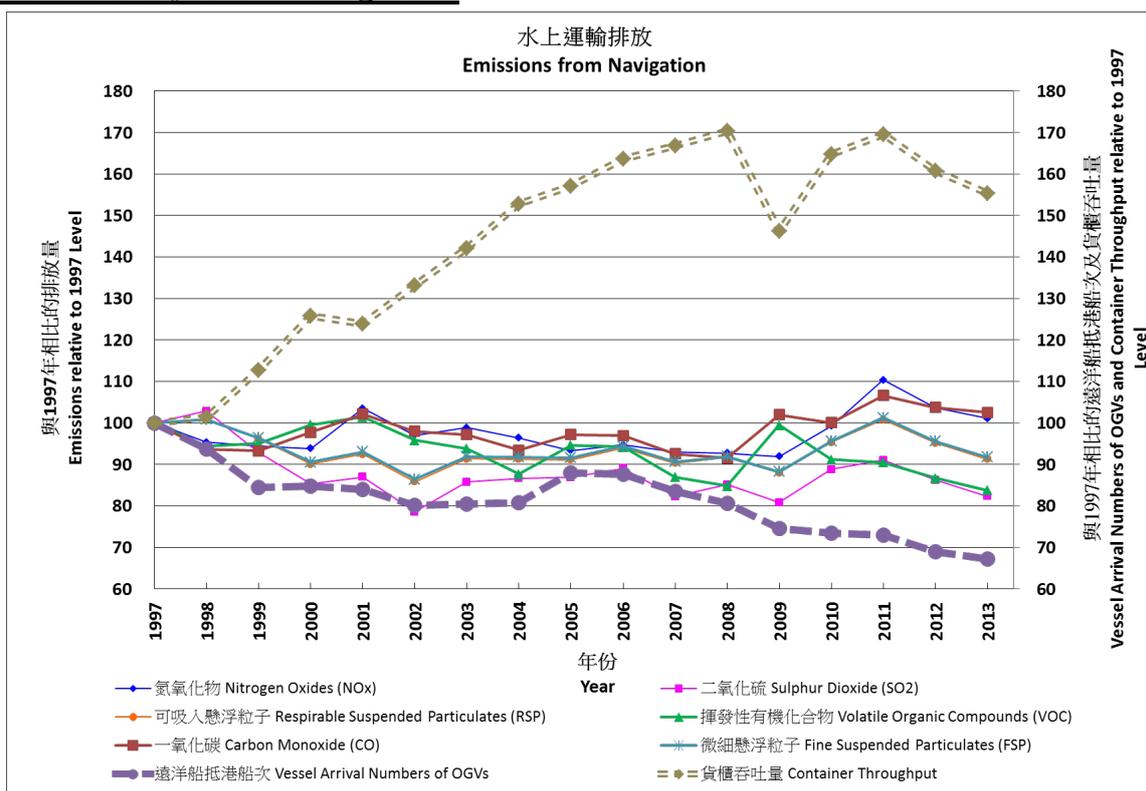


5.4 Road transport was a major emission source of NO_x, RSP, FSP, VOC and CO, accounting for 23%, 18%, 21%, 23% and 59% of the total emissions in 2013, respectively. Overall, the emissions decreased by 36% to 98% from 1997 to 2013, despite an increase in vehicle-kilometer-travelled of 13%.

5.5 The decreases in NO_x, RSP, FSP, VOC and CO emissions from 2010 to 2013 could be attributable to an array of vehicle emission control programmes, including the progressive tightening of vehicle emission standards from Euro III in 2001 to Euro V in 2012 and providing a one-off subsidy to vehicle owners for the replacement of the catalytic converters and oxygen sensors of petrol / Liquefied Petroleum Gas taxis and light buses which started in August 2013.

5.6 As for SO₂, the vehicle emissions stayed at a very low level in the past few years because of the introduction of Euro V diesel in December 2007, whose sulphur content is capped at 0.001%.

Sectoral analysis for “Navigation”



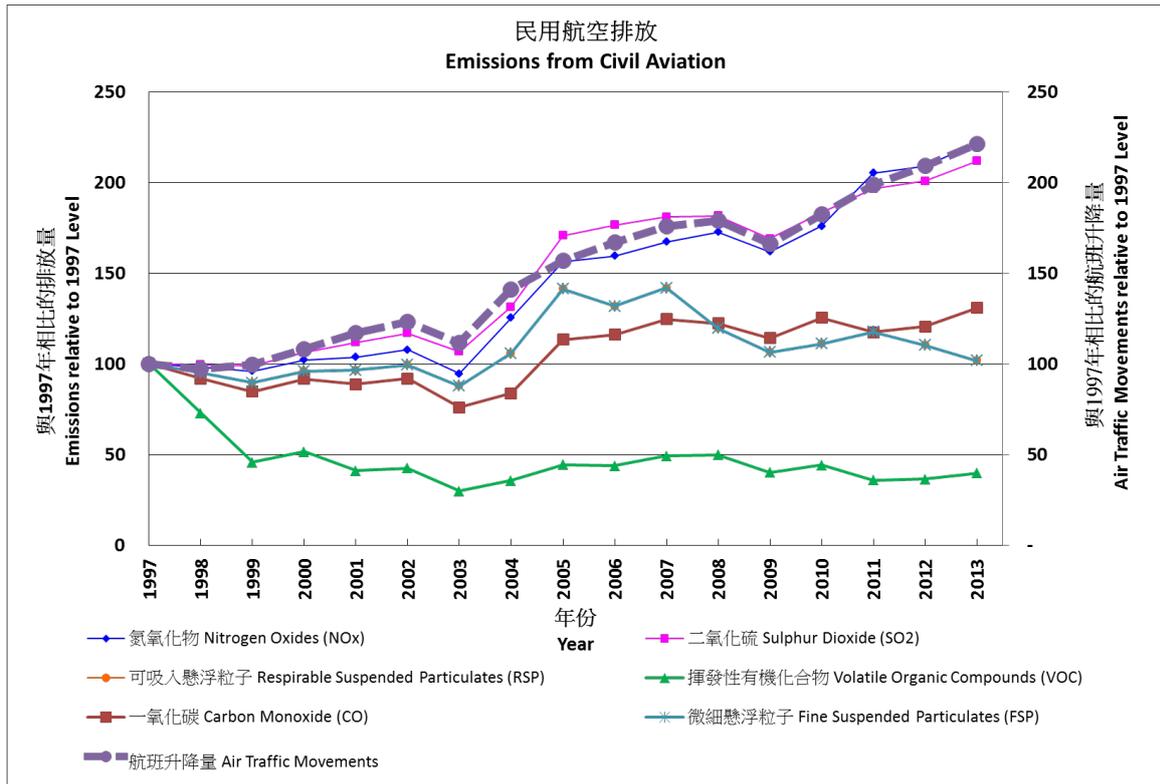
5.7 Emissions from navigation sector were relatively steady between 1997 and 2013. However, the reduced emissions from power plants and road transport over these years had made navigation the largest emission source, accounting for 50%, 31%, 36% and 42% of the total SO₂, NO_x, RSP and FSP emissions respectively in 2013.

5.8 Among vessels, ocean going vessels (OGVs) were major emitters. The following are worth noting-

- (a) the arrival numbers of OGVs decreased by 33% between 1997 and 2013 though the container throughput increased by 55%; and
- (b) as compared with 2010, the arrival numbers of OGVs decreased by 8% and container throughput by 6%.

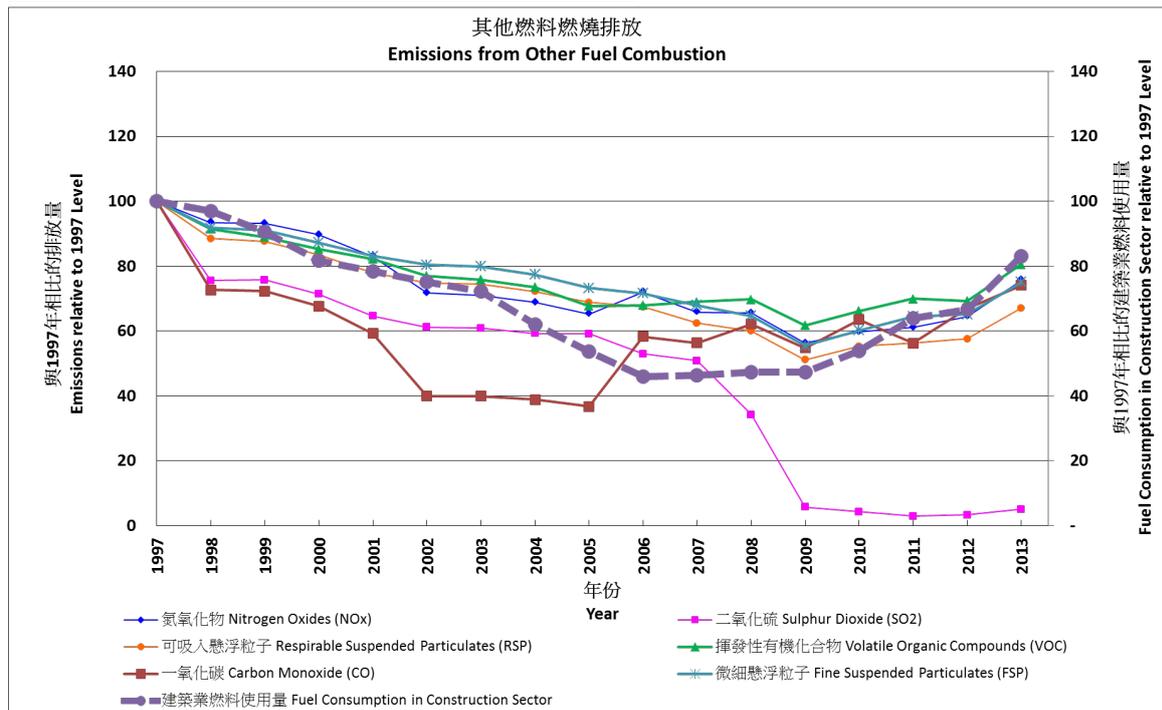
5.9 In 2013, shipping companies continued their voluntary ship emissions reduction scheme, the Fair Winds Charter, by capping the sulphur content of the fuel of their OGVs at 0.5% when the OGVs were at berth here. The Government also reduced by half the port facilities and light dues of OGVs using fuel with sulphur content not more than 0.5% while berthing. The Air Pollution Control (Ocean Going Vessels) (Fuel at Berth) Regulation, which mandates OGVs to use low-sulphur marine fuel (sulphur content not exceeding 0.5%) while berthing in Hong Kong, will come into effect on 1 July 2015.

Sectoral analysis for “Civil aviation”



5.10 Emissions from civil aviation accounted for less than 6% of the total local emissions of air pollutants in 2013. From 1997 to 2013, the air traffic movements increased by 121% and the emissions of SO₂ and NO_x increased by a similar extent.

Sectoral analysis for “Other fuel combustion”

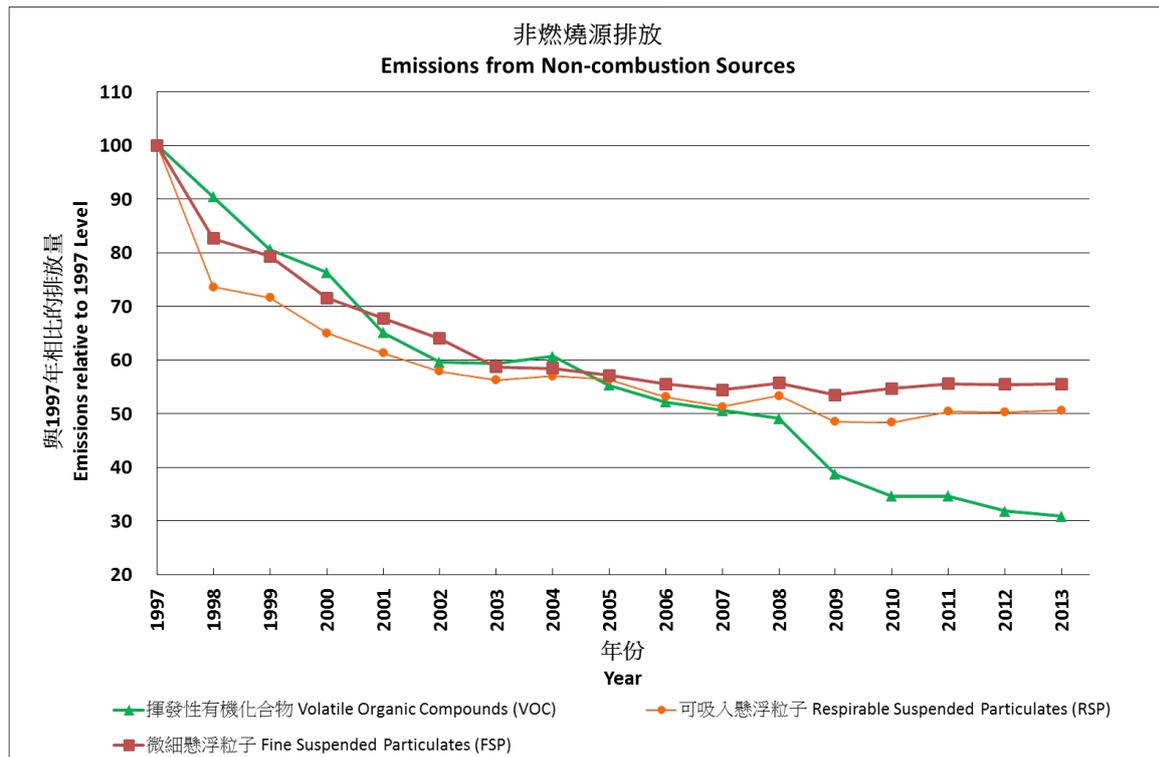


5.11 Other fuel combustion sector is one of the important sources of RSP and FSP emissions, accounting for 14% and 16% of the total emissions in 2013, respectively. Overall, the emissions decreased by 19% to 95% from 1997 to 2013.

5.12 Major contributing sources in this sector are non-road mobile machineries, especially construction machinery, which accounted for 72%, 77% and 68% of RSP, FSP and NO_x emissions respectively in 2013. Hence, the increases in RSP, FSP and NO_x emissions from 2009 to 2013 could be attributable to the rising construction activities, as reflected in the fuel consumption in construction sector, which increased by 76% during the period.

5.13 The SO₂ emissions from this sector have been reduced to a very low level since the Air Pollution Control (Fuel Restriction) Regulation tightened the cap on the sulphur content of diesel used in industrial and commercial sectors from 0.5% to 0.005% in October 2008. Information collected from the Customs and Excise Department indicated that since January 2009, only Euro V diesel (with sulphur content not exceeding 0.001%) has been imported for industrial and construction use.

Sectoral analysis for “Non-combustion sources”



5.14 Non-combustion sources sector contributes considerably to local VOC emissions, accounting for 58% in 2013, whereas its contributions to local RSP and FSP emissions in 2013 were 16% and 10%, respectively. Overall, the emissions of the sector decreased by 44% to 69% from 1997 to 2013.

5.15 Major contributing sources for VOC in this sector are emissions from the use of architectural paints, printing inks and associated solvents, and consumer products, which accounted for 75% of VOC emissions in 2013. As compared with 2008, the VOC emissions from non-combustion sources decreased by 37% in 2013 mainly because of the enforcement of the Air Pollution Control (Volatile Organic Compounds) Regulation since 2007.

5.16 The Regulation prohibits the import and local manufacture of regulated products with VOC contents exceeding the legal limits and controls emissions from lithographic heatset web printing machines. The regulated products include 6 categories of consumer products, 51 types of architectural paints, 7 types of printing inks, 14 types of vehicle refinishing paints, 36 types of vessel and pleasure craft paints and 47 types of adhesives and sealants.

6 EMISSION REDUCTION PLAN UP TO 2020

6.1 The Hong Kong SAR and Guangdong Provincial Governments have long been collaborating to improve air quality in the Pearl River Delta (PRD) Region¹. Over the past years, the two Governments significantly reduced the emissions of four major pollutants, namely SO₂, NO_x, RSP and VOC. At the meeting of Hong Kong-Guangdong Joint Working Group on Sustainable Development and Environmental Protection held in November 2012, both sides endorsed a new set of emission reduction targets/ranges up to 2020, using 2010 as the base year (details in **Annex 4**). Both sides have been implementing additional pollution control measures on this basis for bringing continuous improvement to the regional air quality.

6.2 In order to achieve the emission targets/ranges set for 2015 and 2020, Hong Kong has implemented the following key measures:

- ◆ Completed in April 2014 a one-off subsidy scheme to replace the catalytic converters and oxygen sensors of petrol / Liquefied Petroleum Gas (LPG) taxis and light buses;
- ◆ Launched in March 2014 an incentive-cum-regulatory scheme to phase out some 82,000 pre-Euro IV diesel commercial vehicles by end 2019;
- ◆ Strengthened the inspection and maintenance of LPG and petrol vehicles from September 2014 by deploying roadside remote sensing equipment to detect excessive emissions from petrol and LPG vehicles;
- ◆ Tightened the limit on sulphur content of locally supplied marine light diesel to 0.05% in April 2014;
- ◆ Tightened progressively the emission caps on power plants, with the latest emission caps effective in 2019; and
- ◆ Continued to enforce the Air Pollution Control (Volatile Organic Compounds) Regulation to control volatile organic compounds emissions from paints, printing inks, adhesives, sealants and selected consumer products.

6.3 Other measures in the pipeline include:

- ◆ Mandating the use of low-sulphur fuel for ocean-going vessels berthing in Hong Kong from 1 July 2015 under the Air Pollution Control (Ocean Going Vessels) (Fuel at Berth) Regulation;
- ◆ Controlling the emissions from off-road mobile machinery from 1 September 2015 under the Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation; and
- ◆ Retrofitting Euro II and Euro III franchised buses with selective catalytic reduction devices to reduce their emissions.

6.4 Such measures will help us to achieve the emission reduction targets for 2015 and 2020, and to meet broadly the existing Air Quality Objectives by 2020.

6.5 The changes in emissions in 2013 compared with emissions in 2010 in Hong Kong are shown in the following table.

¹ PRD Region refers to the whole territory of HKSAR and the Pearl River Delta Economic Zone (PRDEZ). PRDEZ includes Guangzhou, Shenzhen, Zhuhai, Dongguan, Zhongshan, Foshan, Jiangmen, Huizhou (Huicheng, Huiyang, Huidong, Boluo), and Zhaoqing (Duanzhou, Dinghu, Gaoyao, Sihui).

Table 6-1 Changes in emissions between 2010 and 2013

Pollutant	Emissions (Tonnes)			2015 Emission Reduction Targets
	2010	2013	Change in Emission	
SO ₂	35,490	31,280	-12%	-25%
NO _x	108,360	113,220	+4%	-10%
RSP	6,270	6,040	-4%	-10%
VOC	32,870	29,420	-10%	-5%

Note: Emission figures are presented in the nearest ten.

6.6 Compared with the base year of 2010, SO₂, RSP and VOC emissions in 2013 had decreased by 4% to 12%. However, NO_x emissions had increased by 4% which was due to the higher coal consumption for electricity generation and the increase in construction and aviation activities.

- End -

Annex 1 – Breakdown of Emission Inventory by Source Categories from 2012 to 2013

Pollutant	Source Categories	Emissions (Tonnes)	
		2012	2013
SO ₂	Public Electricity Generation	15,490	14,680
	Road Transport	50	50
	Navigation	16,480	15,740
	Civil Aviation	510	540
	Other Fuel Combustion	180	280
	Non-combustion	N/A	N/A
	Total	32,710	31,280
NO _x	Public Electricity Generation	32,020	34,580
	Road Transport	30,720	25,740
	Navigation	36,510	35,630
	Civil Aviation	5,870	6,240
	Other Fuel Combustion	9,400	11,040
	Non-combustion	N/A	N/A
	Total	114,510	113,220
RSP	Public Electricity Generation	960	940
	Road Transport	1,200	1,090
	Navigation	2,250	2,160
	Civil Aviation	60	60
	Other Fuel Combustion	730	850
	Non-combustion	940	950
	Total	6,140	6,040
FSP	Public Electricity Generation	450	430
	Road Transport	1,100	1,000
	Navigation	2,080	2,000
	Civil Aviation	60	60
	Other Fuel Combustion	670	780
	Non-combustion	480	480
	Total	4,840	4,740
VOC	Public Electricity Generation	440	460
	Road Transport	7,420	6,650
	Navigation	3,480	3,360
	Civil Aviation	530	580
	Other Fuel Combustion	1,010	1,170
	Non-combustion	17,740	17,200
	Total	30,620	29,420
CO	Public Electricity Generation	3,890	3,930
	Road Transport	44,090	35,840
	Navigation	11,810	11,670
	Civil Aviation	3,060	3,320
	Other Fuel Combustion	5,450	6,040
	Non-combustion	N/A	N/A
	Total	68,300	60,790

Note: - All figures are rounded to the nearest ten.
- "N/A" denotes not applicable.
- There may be slight discrepancies between the sums of individual items and the totals shown in the table because of rounding.

Annex 2 – Summary of Updates to the Emission Inventory

1. Making reference to international developments and technological advancement, we have been updating the methodologies to compile emission inventories including the collection of most updated data with an aim to provide a better support to the management of air quality. Whenever the compilation methodology is updated, new activity data are collated, or errors in the estimates are identified, we will follow international practice to update the emission inventory and to revise the emission inventories for past years as far as practicable based on the updated methods and data to enable consistent and reliable emission trend analysis to be made.
2. Recalculation of historical emission inventories is widely adopted by environmental agencies such as European Environmental Agency of the European Community, California Air Resources Board (CARB), United Nations Environment Programme (UNEP), Intergovernmental Panel on Climate Change (IPCC), etc. when methods are changed or refined, when new sources categories are included in the inventory or when assumptions used in the estimates are revised.
3. Since the publication of the emission inventory on EPD's website in 2000, EPD have made a number of updates to the emission compilation and recalculated the historical emissions.
4. Major updates to the emission inventories in recent years are highlighted below.
 - i. EPD commissioned a comprehensive study on the marine emission inventory in 2008, which was completed in 2012. The study collected extensive local vessel activity data and reviewed the latest emission compilation methodologies of advanced places such as the Port of Los Angeles of the USA. The study concluded that these latest emission compilation methodologies can provide more realistic estimates of marine emissions. Based on the study findings, we updated the previous emission inventories for marine vessels. The updated emissions from vessels were higher than the previous ones.
 - ii. EPD have been conducting emission measurements for on-road vehicles by means of remote sensing equipment and advanced portable emission measurement systems (PEMS). The measurements have provided a more robust basis for us to estimate vehicle emissions. They have also found that vehicles with inadequate maintenance, e.g. LPG vehicles with worn-out catalytic converters, could emit considerably above their normal levels. We made use of the findings to update our vehicle emission estimation model and compile the vehicle emission inventory.
 - iii. Since the implementation of the Air Pollution Control (Volatile Organic Compounds) Regulation in April 2007, we have used the sales report data submitted by importers under the Regulation to compile VOC emissions of regulated products including six types of consumer products (air fresheners, hairsprays, multi-purpose lubricants, floor wax strippers, insecticides and insect repellents), printing inks, paints, adhesives and sealants. In April 2012, we further regulated the VOC contents of vehicle refinishing and marine paints (vessels and pleasure craft paints) and started to compile the VOC emissions from these paints based on their sales report data. Emissions from cleansing solvents during the application of paints have also been estimated. To compile VOC emissions for the regulated products, we also made reference to EPD's studies on printing industry, solvent usage for coatings and

VOC-containing products, and survey data for marine paints to assess emissions from VOC-containing products.

5. Updates to the emission inventories since their first publication in March 2000 are summarized in the table below. Based on the latest updates, we have recalculated historical emission inventories from 1997 to 2012. Comparisons between the previous and recalculated inventories are shown in **Annex 3**.

Update Date	Emission Inventory Revised	Revisions and Updates
March 2000	1990-1998	<ul style="list-style-type: none"> • First publication of emission inventory for PM, SO₂, NO_x, NMVOCs and CO from combustion sources at the EPD's website.
December 2000	1990-1999	<ul style="list-style-type: none"> • Amended emission inventory for Public Electricity Generation, Road Transport and Other Fuel Combustion sources.
December 2001	1990-2000	<ul style="list-style-type: none"> • Amended combustion sources emissions (including emission factors for VOC emissions from coal-fired electricity generation units, vehicle kilometer travel (vkt) for Road Transport, emission estimation methods for Navigation and Civil Aviation and surrogates for Other Fuel Combustion emissions).
February 2003	1990-2001	<ul style="list-style-type: none"> • Replaced Census and Statistics Department (C&SD) retained import data for fuel with Energy End-use data from Electrical and Mechanical Services Department (EMSD). • Amended vkt data.
June 2004	1990-2002	<ul style="list-style-type: none"> • Replaced emission estimated using emission factors with sophisticated EMFAC model to estimate emissions from Road Transport. • Included additional emission sources for RSP and VOC. • Replaced 2000 to 2001 Public Electricity Generation emissions for SO₂, NO_x and PM with data provided the power companies.
January to March 2005	1990-2003	<ul style="list-style-type: none"> • Amended 2000 to 2002 SO₂, NO_x and PM emissions for Public Electricity Generation according to data provided by the power companies. • Updated emissions estimated using the EMFAC model. • Amended 2001-02 emissions using Energy End-Use Data from EMSD. • Excluded Biogenic VOC emission sources from total VOC emission.
December 2005	1990-2004	<ul style="list-style-type: none"> • Amended 2002-03 emissions using Energy End-Use Data from EMSD. • Updated emission factors for VOC emissions from the printing industry.
December 2006	1990-2005	<ul style="list-style-type: none"> • Amended 2003 to 2004 SO₂, NO_x and PM emissions for Public Electricity Generation according to data provided by the power companies. • Updated fuel use for vehicles to calculate 1998 to 2004 SO₂ emissions. • Updated emission factors for VOC emissions from the printing industry.
January 2008	1990-2006	<ul style="list-style-type: none"> • Replaced Power Plant PM emissions with RSP emissions using emission factors from USEPA. • Updated emission factors for emission from non-road mobile

		<p>equipment at the airport, container terminal and construction sites.</p> <ul style="list-style-type: none"> • Included VOC emissions from evaporation of gasoline. • Included RSP emissions from tyre, brake and road wear. • Amended estimation method for VOC emissions from printing industry and fuel storage tanks. • Updated emission factors for Civil Aviation emission sources.
January 2009	1990-2007	<ul style="list-style-type: none"> • Used information collected from Government Departments and shipping industry to estimate emissions from local vessels. • Updated emission factors for emission from non-road mobile equipment at the airport and container terminal.
September 2012	1997-2010	<ul style="list-style-type: none"> • Based on the results from the Marine Emission Study report completed in 2012 to update emissions from Navigation. Additional information for fuel use and vessel activities were used to calculate the emission. • Amended emission factors for NOx emission from vehicles using data collected from Portable Emission Measurement Systems (PEMS). • Used updated version of EMFAC (version 2.1) for Road Transport emission estimation. • Used updated version of EDMS (version 5.1.3) for Civil Aviation emission estimation. • Included emissions from auxiliary power units of the aircrafts parking at the gates of the airport. • Used sales report data to calculate VOC emissions from products controlled under the VOC Regulation. • Used further local reported and survey data for VOC emission calculation. • Used new reported and survey results to calculate emissions from Other Fuel Combustion sources. • Included RSP emissions from construction sites and cooking; Included VOC emissions from storage of naphthalene, aviation fuel and use of cleaning solvents associated with paint use.
February 2013	1997-2011	<ul style="list-style-type: none"> • Used C&SD data to derive fuel consumption data for construction sector from 1997 to 2011. • Amended VOC emissions from architectural paints in 2010 due to a correction in the paint consumption data.
January 2014	1997-2012	<ul style="list-style-type: none"> • We compiled the emission inventory of FSP as it is one of the major air pollutants stipulated in the new Air Quality Objectives (AQOs) which takes effect from 1 January 2014. • Emissions of OGVs during shifting between berthing locations were compiled since more detailed vessel activity data were collected from the Marine Department. • New surrogates for fuel consumption for the construction and industrial sectors were derived from C&SD data since the previously used Energy End-Use data from EMSD are no longer suitable after a major revision. • Having regard to the real world developments, the sulphur content of aviation fuel, duration of landing and take-off cycles of aircraft at Hong Kong International Airport and hence the air pollutant emissions from Civil Aviation sector have been updated. • Screen printing emissions were updated according to additional survey data to cover emissions in the application of screen printing inks on non-paper substrates, of which this

		type of inks was exempted from the VOC Regulation.
January 2015	2009-2012	<ul style="list-style-type: none">• VOC emissions from architectural paints in 2012 were updated using VOC contents of the latest sales reports submitted by importers.• VOC emissions from screen printing from 2009 to 2012 were revised based on our latest survey which revealed a reduction in the local use of non-regulated screen printing ink.

Annex 3 – Comparison between the Previous and Recalculated Inventories from 1997 to 2012

Table A3-1 Changes in SO₂ emission inventories from 1997 to 2012

Year	SO ₂ (Tonnes)		
	Previous*	Recalculated*	% Changes
1997	82,060	82,260	0.2%
1998	87,130	87,310	0.2%
1999	72,290	72,480	0.3%
2000	79,570	79,750	0.2%
2001	81,580	81,730	0.2%
2002	79,610	79,750	0.2%
2003	104,730	104,850	0.1%
2004	108,560	108,680	0.1%
2005	98,200	98,320	0.1%
2006	87,250	87,350	0.1%
2007	79,740	79,820	0.1%
2008	69,370	69,430	0.1%
2009	62,570	62,580	0.0%
2010	35,490	35,490	0.0%
2011	32,110	32,120	0.0%
2012	32,720	32,710	0.0%

* Figures are rounded to the nearest ten.

Figure A3-1 SO₂ emissions trend from 1997 to 2012

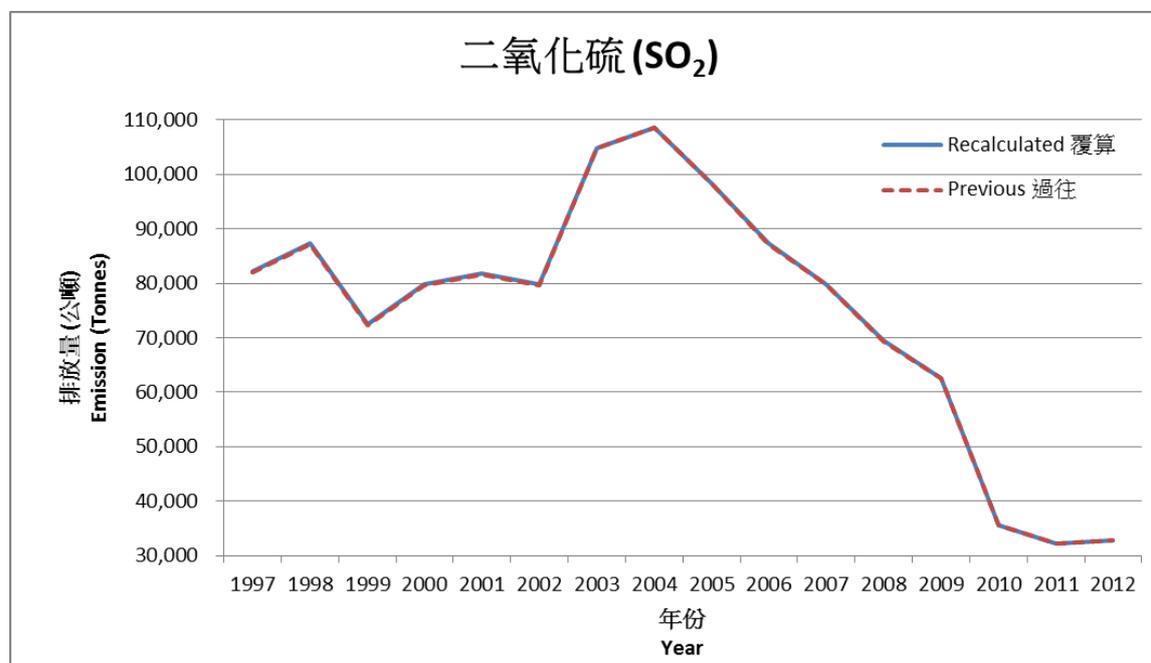


Table A3-2 Changes in NOx emission inventories from 1997 to 2012

Year	NOx (Tonnes)		
	Previous*	Recalculated*	% Changes
1997	148,560	148,630	0.0%
1998	144,570	144,640	0.0%
1999	130,210	130,280	0.1%
2000	131,040	131,110	0.1%
2001	127,770	127,830	0.0%
2002	125,180	125,230	0.0%
2003	139,690	139,740	0.0%
2004	128,950	129,000	0.0%
2005	129,120	129,170	0.0%
2006	125,580	125,630	0.0%
2007	126,890	126,940	0.0%
2008	120,180	120,220	0.0%
2009	116,180	116,210	0.0%
2010	108,330	108,360	0.0%
2011	116,260	116,240	0.0%
2012	114,530	114,510	0.0%

* Figures are rounded to the nearest ten.

Figure A3-2 NOx emission trend from 1997 to 2012

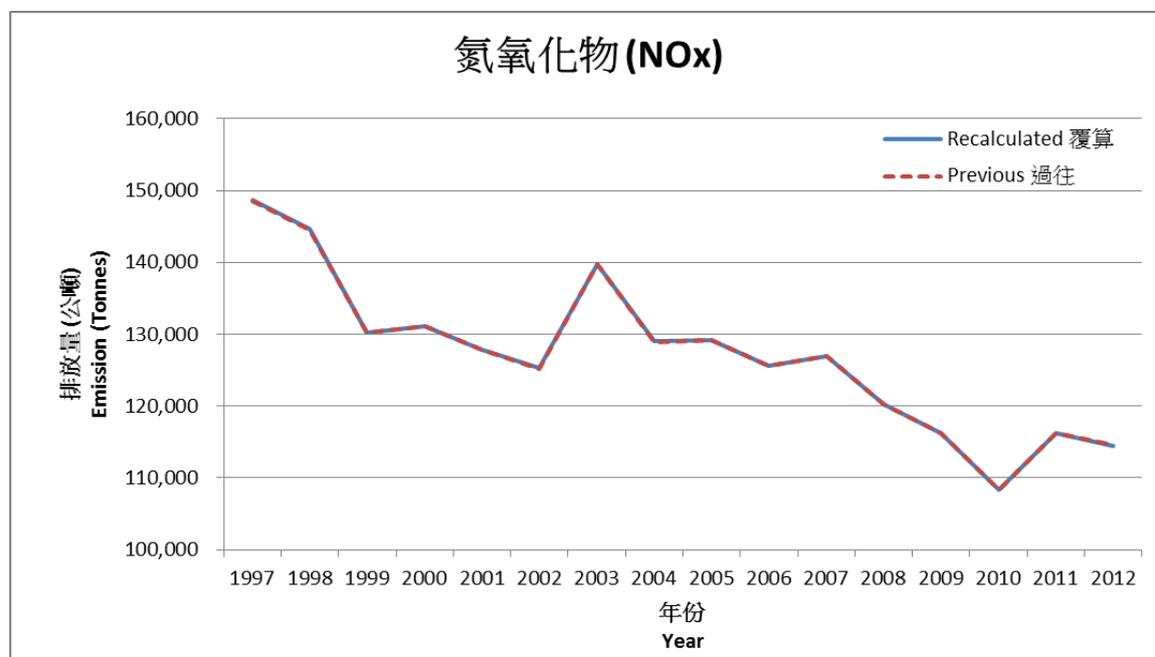


Table A3-3 Changes in RSP emission inventories from 1997 to 2012

Year	RSP (Tonnes)		
	Previous*	Recalculated*	% Changes
1997	14,500	14,580	0.6%
1998	13,290	13,380	0.7%
1999	11,780	11,880	0.9%
2000	11,360	11,420	0.5%
2001	9,810	9,880	0.8%
2002	9,080	9,080	0.0%
2003	8,950	9,000	0.5%
2004	9,210	9,220	0.2%
2005	8,470	8,490	0.2%
2006	7,840	7,870	0.4%
2007	7,230	7,240	0.2%
2008	6,940	7,000	0.9%
2009	6,570	6,590	0.3%
2010	6,250	6,270	0.3%
2011	6,270	6,280	0.2%
2012	6,130	6,140	0.1%

* Figures are rounded to the nearest ten.

Figure A3-3 RSP emission trend from 1997 to 2012

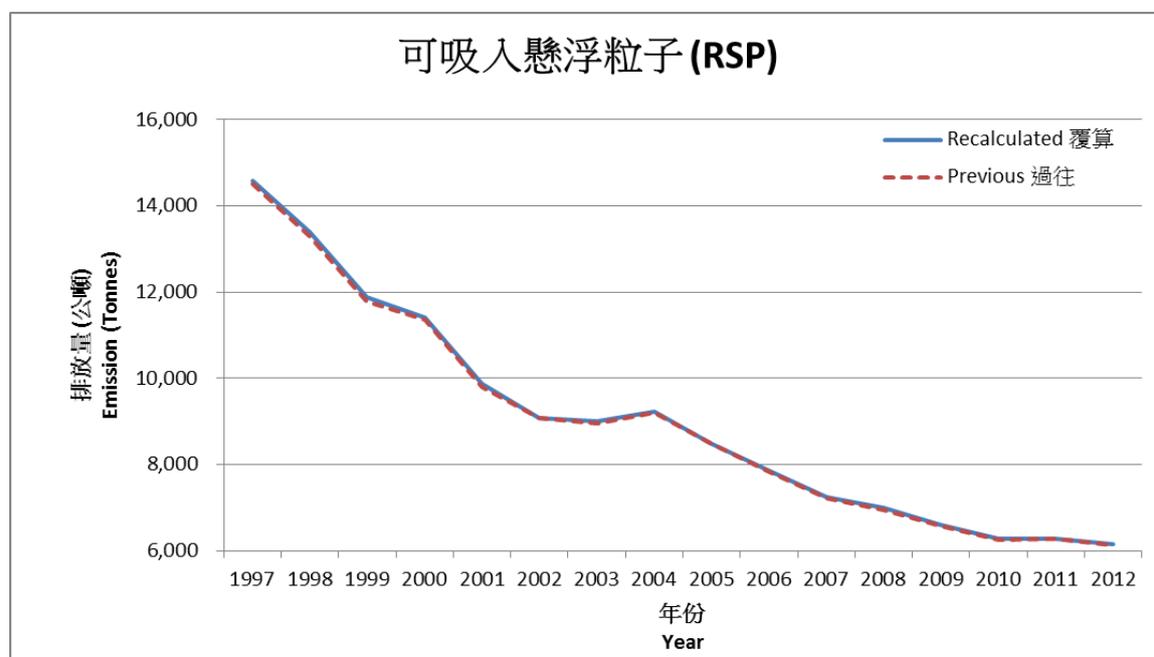


Table A3-4 Changes in FSP emission inventories from 1997 to 2012

Year	FSP (Tonnes)		
	Previous*	Recalculated*	% Changes
1997	11,110	11,150	0.4%
1998	10,320	10,370	0.5%
1999	9,290	9,350	0.7%
2000	8,700	8,750	0.6%
2001	7,730	7,800	0.9%
2002	7,010	7,010	0.0%
2003	6,660	6,680	0.4%
2004	6,620	6,640	0.2%
2005	6,200	6,210	0.2%
2006	5,880	5,900	0.5%
2007	5,480	5,490	0.3%
2008	5,270	5,290	0.4%
2009	4,950	4,960	0.4%
2010	4,920	4,940	0.4%
2011	4,940	4,950	0.2%
2012	4,840	4,840	0.2%

* Figures are rounded to the nearest ten.

Figure A3-4 FSP emission trend from 1997 to 2012

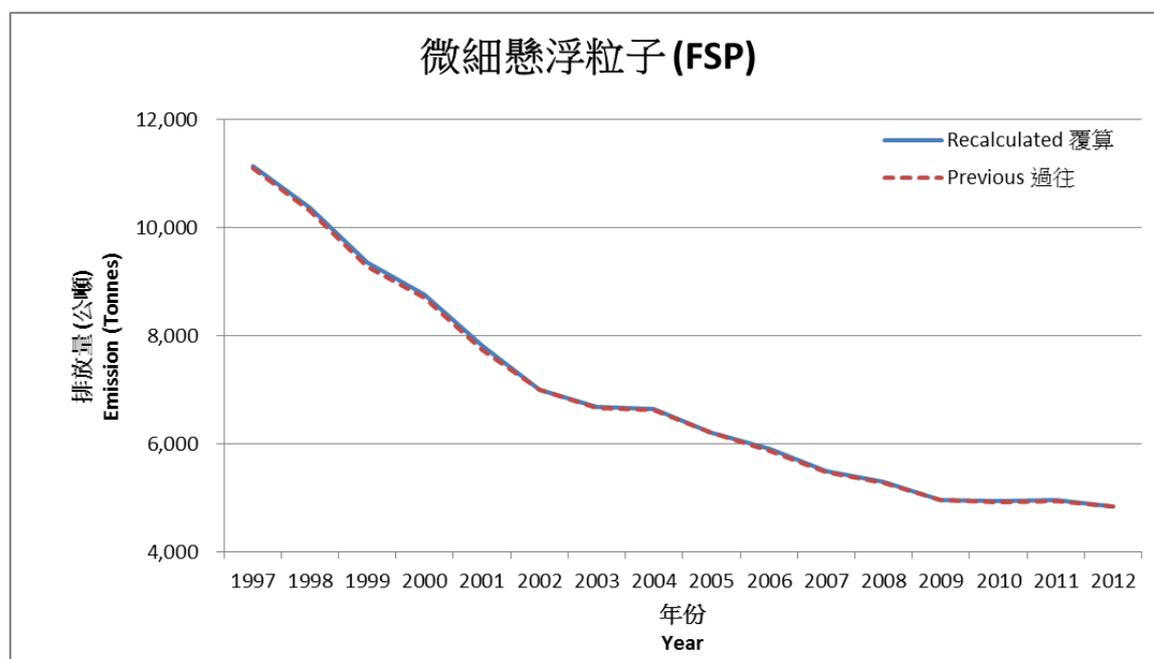


Table A3-5 Changes in VOC emission inventories from 1997 to 2012

Year	VOC (Tonnes)		
	Previous*	Recalculated*	% Changes
1997	81,210	81,390	0.2%
1998	73,950	74,130	0.2%
1999	66,850	67,010	0.2%
2000	63,460	63,630	0.3%
2001	55,880	56,060	0.3%
2002	51,330	51,520	0.4%
2003	49,730	49,910	0.4%
2004	49,590	49,790	0.4%
2005	46,290	46,470	0.4%
2006	44,120	44,290	0.4%
2007	42,620	42,810	0.4%
2008	41,780	41,480	-0.7%
2009	35,910	35,560	-1.0%
2010	33,210	32,870	-1.0%
2011	32,290	32,370	0.3%
2012	32,220	30,620	-5.0%

* Figures are rounded to the nearest ten.

Figure A3-5 VOC emission trend from 1997 to 2012

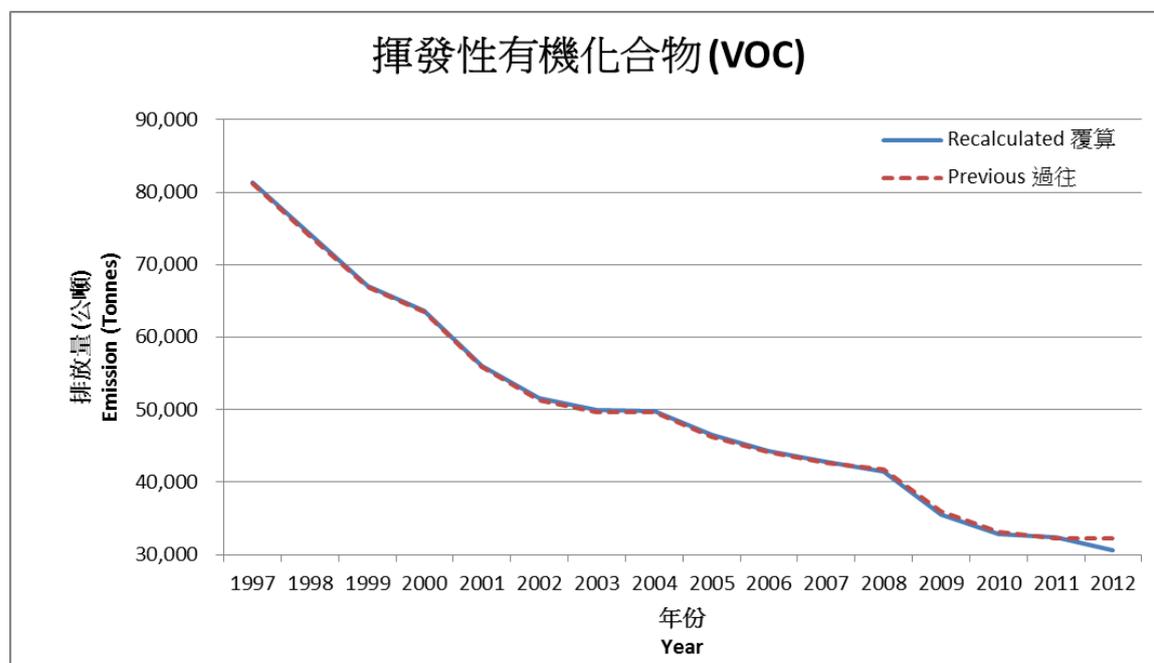
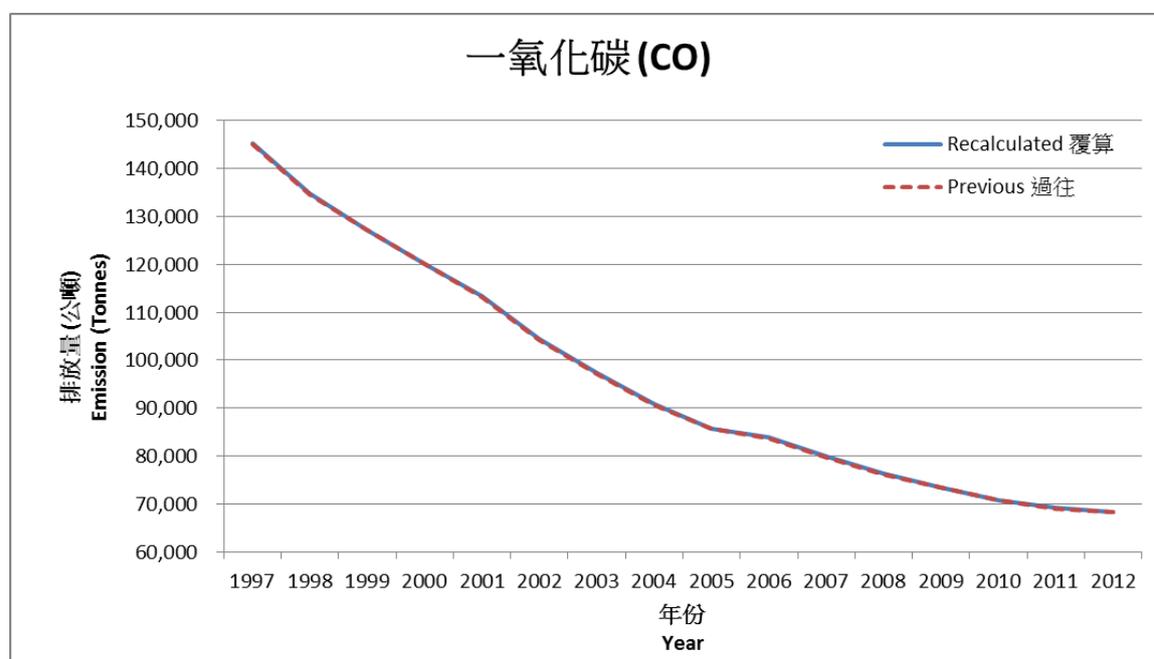


Table A3-6 Changes in CO emission inventories from 1997 to 2012

Year	CO (Tonnes)		
	Previous*	Recalculated*	% Changes
1997	145,100	145,220	0.1%
1998	134,620	134,730	0.1%
1999	127,130	127,230	0.1%
2000	120,020	120,120	0.1%
2001	113,170	113,270	0.1%
2002	104,240	104,330	0.1%
2003	97,150	97,240	0.1%
2004	90,620	90,710	0.1%
2005	85,610	85,690	0.1%
2006	83,730	83,800	0.1%
2007	79,710	79,790	0.1%
2008	76,140	76,210	0.1%
2009	73,390	73,450	0.1%
2010	70,620	70,670	0.1%
2011	69,050	69,090	0.1%
2012	68,260	68,300	0.0%

* Figures are rounded to the nearest ten.

Figure A3-6 CO emission trend from 1997 to 2012



Annex 4 –Emission Reduction Targets / Ranges up to 2020

At the 12th meeting of Hong Kong-Guangdong Joint Working Group on Sustainable Development and Environmental Protection held in November 2012, the two governments endorsed a new set of emission reduction targets/ranges up to 2020, using 2010 as the base year (see table below). The two governments have been implementing emission reduction measures for achieving the 2015 emission reduction targets and will embark a mid-term review to assess the attainment of the emission reduction targets. The review will also finalize the emission reduction targets for 2020, which will further improve the regional air quality.

Pollutant	Area	2015 Emission Reduction Target* (%)	2020 Emission Reduction Range* (%)
SO ₂	Hong Kong	-25%	-35% ~ -75%
	PRD Economic Zone	-16%	-20% ~ -35%
NO _x	Hong Kong	-10%	-20% ~ -30%
	PRD Economic Zone	-18%	-20% ~ -40%
RSP	Hong Kong	-10%	-15% ~ -40%
	PRD Economic Zone	-10%	-15% ~ -25%
VOC	Hong Kong	-5%	-15%
	PRD Economic Zone	-10%	-15% ~ -25%

*Emission reduction targets/ranges using 2010 as the base year.