**RT Paper 2/2016**

**For information**
**on 24 June 2016**

**AQO Review Working Group**
**Road Transportation Sub-group**

# Roadside Air Quality and the Vehicle Emission Control Measures

## PURPOSE

This paper briefs Members on the roadside air quality and the relevant vehicles emission control measures to facilitate Members brainstorming on new air quality improvement measures.

## BACKGROUND

### Major Air Pollution Source

2. Road transport, navigation and public electricity generation are three major air pollution sources in Hong Kong. In 2014[1], they accounted for 97%, 85%, 67% and 69% of our emissions of sulphur dioxide ($SO_2$), nitrogen oxides (NOx), respirable suspended particulates (RSP) and fine suspended particulates (FSP) respectively. Road transport sector is one of the important sources of NOx, RSP and FSP emissions (except $SO_2$), accounting for 19%, 14% and 17% of the total emissions respectively. The breakdown of Hong Kong emission inventory in 2014 is shown in **Annex A**.

### Roadside Air Quality

3. Traffic conditions affect vehicular emissions, traffic congestions slow down travel speed, which in turn generate higher pollutants emissions. The number of vehicles in Hong Kong has grown significantly (i.e. 37 %) from 2004 to 2015 and reached 728 000 as at end 2015. During the same period, the number of private cars has jumped by 51 % to 522 000. The increasing number of vehicles may exacerbate the traffic congestion and worsen the roadside air quality.

[1] The 2014 Hong Kong emission inventory is the latest available version.

4. Diesel commercial vehicles (DCVs) and buses are the main sources of roadside air pollution as diesel engines emit more RSP and NOx (both of which are the major roadside air pollutants). In 2014, emissions from diesel vehicles (including goods vehicles, buses and light buses) constituted about 97 % and 78% respectively of Hong Kong's total vehicular RSP and NOx emissions.

5. To improve roadside air quality, Environmental Protection Department (EPD) has implemented a host of air improvement measures targeting vehicle emissions and observed encouraging signs of improvement. From 2011 to 2015, the roadside concentrations of RSP, FSP, $NO_2$ and $SO_2$ reduced by 26%, 21%, 19% and 33% respectively (in **Annex B**). Only ozone exhibited a rising trend due to the strong influence of regional pollution. The status of compliance with the AQO in 2015 is set out in **Annex C**.

## MEASURE TO IMPROVE ROADSIDE AIR QUALITY

### Vehicle Emission Control Measures

6. Tailpipe emissions are the key source of air pollution at the roadside though regional background ozone and particulates levels also have a bearing. To improve roadside air quality, we have introduced a host of vehicle emission control measures in recent years and the key measures are as follows:

- Launched an incentive-cum-regulatory scheme on 1 March 2014 to progressively phase out some 82 000 pre-Euro IV DCVs by the end of 2019, and limited the service life of DCVs newly registered on or after 1 February 2014 to 15 years.
- Completed a subsidy scheme in April 2014 to help about 17,000 LPG and petrol taxi and light bus owners replacing their catalytic converters and oxygen sensors.
- Starting from September 2014, strengthened emission control of LPG and petrol vehicles by using mobile roadside remote sensing equipment to detect vehicles with excessive emissions.
- Set up a $300 million Pilot Green Transport Fund in March 2011, encouraging transport operators to try out innovative green and low carbon transport technologies.

- Promoting the wider use of hybrid and electric vehicles by waiving First Registration Tax and expanding the charging network.
- Retrofitting Euro II and III franchised buses with selective catalytic reduction devices to upgrade their emission performance.
- Subsidising the purchase of 6 double-deck hybrid buses and 36 single-deck electric buses for trial runs to assess their operational performance under the local conditions.
- Set up franchised bus low emission zones in three busy corridors in Causeway Bay, Central and Mong Kok in end 2015.
- Preparing to tighten the vehicle emission standards to Euro VI for newly registered vehicles.

**Transport Management and Urban Planning**

7. Furthermore, Bureaux and Departments have been collaborating to reduce roadside air emission through implementing transport management (like rationalizing franchised bus routes) and urban planning measures (such as expanding rail network and developing cycle tracks in new development areas).

## ADVICE SOUGHT

8. Members are invited to note the contents of this paper.

**Environment Bureau / Environmental Protection Department**
**June 2016**

**Annex A**

# Hong Kong Emission Inventory in 2014

| Pollution Sources | Emissions of Major Air Pollutants in 2014 (Tonnes) | | | |
|---|---|---|---|---|
| | **Sulphur dioxide ($SO_2$)** | **Nitrogen oxides (NOx)** | **Respirable suspended particulates (RSP)** | **Fine suspended particulates (FSP)** |
| Public Electricity Generation | 16,880 (53%) | 36,210 (33%) | 980 (17%) | 450 (10%) |
| **Road Transport** | **40 (<1%)** | **21,200 (19%)** | **830 (14%)** | **760 (17%)** |
| Navigation | 14,000 (44%) | 36,200 (33%) | 2,100 (36%) | 1,940 (42%) |
| Civil Aviation | 510 (2%) | 5,500 (5%) | 60 (<1%) | 60 (1%) |
| Other Fuel Combustion (major contributing sources include non-road mobile machineries operating in construction sites and container terminals.) | 280 (1%) | 10,440 (10%) | 820 (14%) | 750 (16%) |
| Non-combustion (sources include paved road dust, cooking fume, paints and associated solvents, and printing etc) | N/A | N/A | 910 (15%) | 470 (10%) |
| Biomass (emissions from biomass burning, e.g. hill fires) | 0 (<1%) | 20 (<1%) | 210 (4%) | 170 (4%) |
| Total | 31,710 | 109,570 | 5,900 | 4,600 |

Notes:

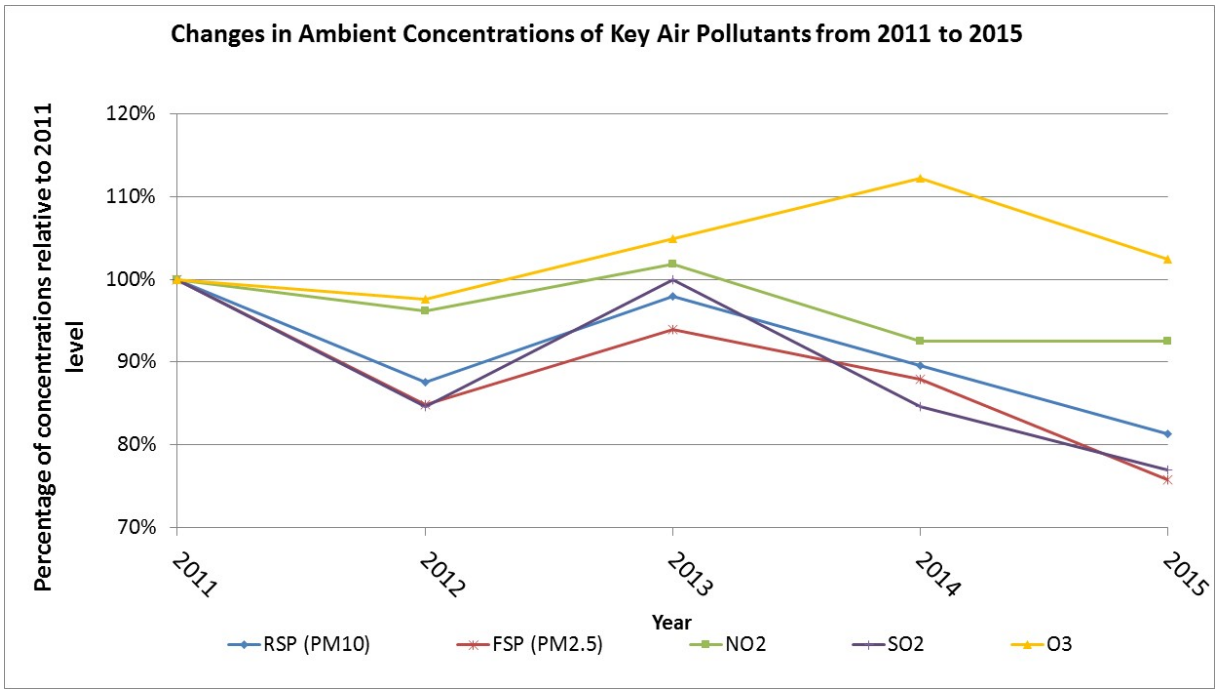
- Figures in parentheses indicate the percentage shares of the air pollutants in different source categories.
- Emission figures are rounded to the nearest ten.
- There may be slight discrepancies between the sums of individual items and the total emissions shown in the table because of rounding.

**Annex B**

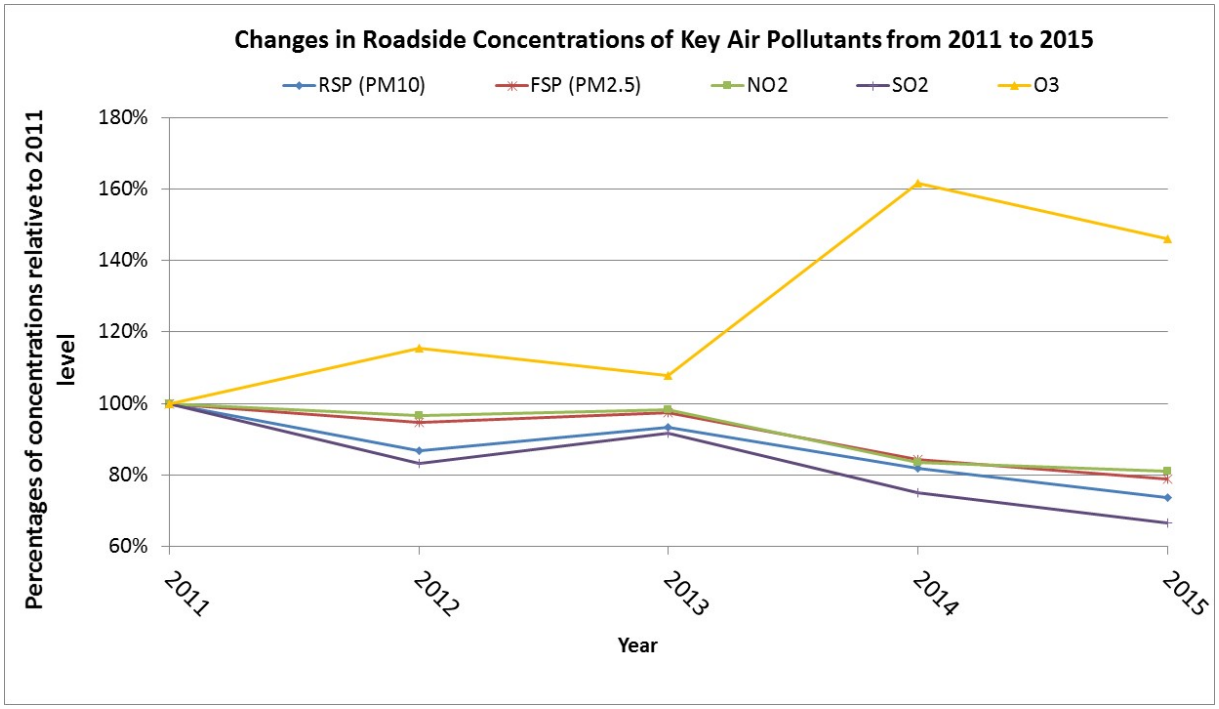
## Annual Average Concentration of Key Air Pollutants from 2011 to 2015 (in µg/$m^3$)

| Air Quality Monitoring Station | | 2011 | 2012 | 2013 | 2014 | 2015 | **Change between 2011 and 2015** |
|---|---|---|---|---|---|---|---|
| RSP ($PM_{10}$) | General | 48 | 42 | 47 | 43 | 39 | **-19%** |
| | Roadside | 61 | 53 | 57 | 50 | 45 | **-26%** |
| FSP ($PM_{2.5}$) | General | 33 | 28 | 31 | 29 | 25 | **-24%** |
| | Roadside | 38 | 36 | 37 | 32 | 30 | **-21%** |
| $NO_2$ | General | 53 | 51 | 54 | 49 | 49 | **-8%** |
| | Roadside | 122 | 118 | 120 | 102 | 99 | **-19%** |
| $SO_2$ | General | 13 | 11 | 13 | 11 | 10 | **-23%** |
| | Roadside | 12 | 10 | 11 | 9 | 8 | **-33%** |
| $O_3$ | General | 41 | 40 | 43 | 46 | 42 | **2%** |
| | Roadside | 13 | 15 | 14 | 21 | 19 | **46%** |

## Air Quality Trend at General Stations



## Air Quality Trend at Roadside Stations



**Annex C**

# Compliance Status of Air Quality Objectives in 2015

| Pollutants | Averaging time | Air Quality Objectives | | Compliance Status[1] | |
|---|---|---|---|---|---|
| | | Concentration Limit Value ($\mu g/m^3$) | Number of Exceedances Allowed | General Station[3] | Roadside Station |
| Sulphur Dioxide | 10-min | 500 | 3 | Yes | Yes |
| | 24-hour | 125 | 3 | Yes | Yes |
| Respirable Suspended Particulates ($RSP/PM_{10}$) | 24-hour | 100 | 9 | No (maximum number of exceedance up to 18) | No (maximum number of exceedance up to 11) |
| | Annual | 50 | Not Applicable | Yes | No (maximum level up to $55\mu g/m^3$) |
| Fine Suspended Particulates ($FSP/PM_{2.5}$) | 24-hour | 75 | 9 | No (maximum number of exceedance up to 11) | No (maximum number of exceedance up to 10) |
| | Annual | 35 | Not Applicable | Yes | No (maximum level up to $37\mu g/m^3$) |
| Nitrogen Dioxide | 1-hour | 200 | 18 | No (maximum number of exceedance up to 67) | No (maximum number of exceedance up to 460) |
| | Annual | 40 | Not Applicable | No (maximum level up to $64\mu g/m^3$) | No (maximum level up to $106\mu g/m^3$) |
| Ozone | 8-hour | 160 | 9 | No (maximum number of exceedance up to 24) | Yes[2] |
| Carbon Monoxide | 1-hour | 30,000 | 0 | Yes | Yes |
| | 8-hour | 10,000 | 0 | Yes | Yes |
| Lead | Annual | 0.5 | Not Applicable | Yes | Yes |

Note:-

(1) An AQO is not in compliance with if any of the general or roadside stations fails to meet that AQO.

(2) Roadside ozone level is usually low due to its rapid reaction with nitrogen oxides emitted from vehicles

(3) Tap Mun station was temporary closed down in Dec. 2015 due to roof maintenance works.