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**For information**
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**Air Quality Objectives Review Working Group**
**Air Science and Health Sub-group**

# The health and economic impact assessment tool

## PURPOSE

This paper provides supplementary information on the health and economic impact assessment tool in response to the comments raised by the Air Science and Health (ASH) Sub-group in the second meeting on 19 September 2016.

## BACKGROUND

2. EPD commissioned the School of Public Health and Primary Care of the Chinese University of Hong Kong (CUHK) to develop a tool to assess the long-term health and economic impact of air pollution in Hong Kong using the most up-to-date data on air pollution, health statistics, and health care costs. The approach/methodology and the application of the tool for this AQO review have been introduced by Prof. T.W. WONG (as representative of CUHK) in the second ASH Sub-group meeting.

3. In response to Members' comments, Prof. WONG reviewed the effects of sulphur dioxide ($SO_2$) and ozone ($O_3$), and the key findings are presented in paragraphs 4 to 7 of this paper. Moreover, the limitations of the impact assessment tool are listed in paragraph 8.

## IMPACTS OF $SO_2$ and $O_3$

4. In the health and economic impact study, major health studies in United Kingdom and Australia have been reviewed, as listed below. $PM_{2.5}$ and $NO_2$ were the major air pollutants being considered in the health impact assessment, and the effects of $SO_2$ and $O_3$ were not considered in the assessment.

i. Committee on the Medical Effects of Air Pollution (COMEAP). The Mortality Effects of Long-Term Exposure to Particulate Air Pollution in the United Kingdom. A Report by the Committee on Medical Effects of Air Pollution. Health Protection Agency, United Kingdom 2010.

ii. Department of Environment and Conservation (NSW). *Air Pollution Economics: Health costs of air pollution in the Greater Sydney Metropolitan Region*, Sydney 2005.

iii. Künzli N, Kaiser R, Medina S, Studnicka M, Oberfeld G, Horak F. *Health costs due to road traffic-related air pollution – an assessment project of Austria, France and Switzerland*. Prepared for the Third Ministerial Conference for Environment and Health, London, 1999.

iv. Walton H, Dajnak D, Beevers S, Williams M, Watkiss P, Hunt A. Understanding the Health Impact of Air Pollution in London. King College London, 2015.

5. According to the Health Risks of Air Pollution in Europe (HRAPIE) Report of WHO European Region, $SO_2$ is correlated with particulate matter (PM) and $NO_2$ and there will be considerable overlap with the estimates from these 2 pollutants. Hence the HRAPIE Report did not recommend considering $SO_2$ in health impact assessment. Although the $SO_2$ short-term daily impact can be calculated mathematically, the consultant does not recommend adding it to the health impact from PM and $NO_2$, because of the problem of collinearity whose extent of overlap is unknown.

6. For $O_3$, according to the recommendations by the WHO HRAPIE Report, only short-term (i.e. daily) impact should be assessed. The consultant has considered the following health effects of $O_3$ :

a. Mortality - Without the actual daily mortality data, a rough estimate was done based on the average daily figure. There were 48 days in 2014 when the mean of the daily 8-hour max of $O_3$ exceeds the WHO AQG 100ug/$m^3$. A total of 43 additional deaths attributable to short-term effects of $O_3$, which is less than 0.7% of the sum total for $NO_2$ (1992.7) and $PM_{2.5}$ (4315.7). Hence, the overall effect of $O_3$ is minimal, and will not affect the conclusion of current HIA study, which is based on the effects of $NO_2$ and $PM_{2.5}$ only.

b. Hospital admissions - It was found that hospital admissions attributable to $O_3$ are smaller than that from $PM_{2.5}$. Since the respective relative risks are estimated from single pollutant models, using hospital admissions attributable to $PM_{2.5}$ has already taken into consideration the overlapping effects by different pollutants (including $O_3$), and there is no need to separately estimate these numbers and add them up.

7. Based on the above rough estimate, $O_3$ pollution would only contribute to an insignificant increase in mortality count, and therefore, it is considered the existing assessment tool is of sufficient coverage to capture the major health impact of air pollution.

**LIMITATIONS**

8. The limitations of the impact assessment tool are listed below:

a. Specific health outcomes, such as the prevalence of asthma, the incidence and prevalence of chronic obstructive pulmonary disease, acute bronchitis, and lost days from work, were not incorporated in the assessment as the local incidence and prevalence data is not sufficient to conduct the health impact assessment.

b. Estimates of hospitalizations do not include private hospital data.

c. The assessment do not included visits to Accident and Emergency Departments (without hospitalization) for cardiovascular and respiratory illnesses, as the relevant statistics are not readily available in the HA and there is no local relative risks (RR) data available related to visits to Accident and Emergency Departments (without hospitalization).

d. The assessment only covers $PM_{2.5}$ and $NO_2$, but not all air pollutants. The considerations on $SO_2$ and $O_3$ have been discussed above. Moreover, the health impact of toxic air pollutants (TAPs) has not been estimated, as their effects are small compared to criteria air pollutants, in particular $PM_{2.5}$.

e. A major source of uncertainty is the baseline data on private general practitioners (GP) consultations for upper respiratory infections (URI). As there are no routinely reported data on the annual total number of consultations to private GPs, the assessment tool is proposed to include the upper and lower ends of estimates of annual private GP consultation data.

f. The study has not looked into the vertical profile of air pollutant distribution in Hong Kong, because (i) comprehensive data on the vertical distribution of air pollutants are not available; (ii) comprehensive exposure assessment data are not available, and (iii) data on the vertical distribution of the population are unavailable.

g. There are different views on the validity of Willingness To Pay (WTP) estimates as WTP values are based on hypothetical situations. The current approach tallies with the methodology recommended in the report "Economic Cost of the Health Impact of Air Pollution in Europe" published by WHO and the Organisation for Economic Co-operation and Development.

h. Local WTP data on morbidity and Value of Statistical Life (VOSL) are not available. To cater for this, the study has made reference to relevant data from the above mentioned report and VOSL value of China from a paper of World Bank.

**ADVICE SOUGHT**

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

**Environment Bureau / Environmental Protection Department**
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