

APPENDIX 10A: INTRODUCTION TO AIR POLLUTION

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10A.1 Introduction

10A.1.1 This appendix is designed to provide further information on the key air pollutants considered in this study.

10A.2 Nitrogen dioxide (NO₂) and nitrogen oxides (NO_x)

10A.2.1 Nitrogen dioxide (NO₂) and nitric oxide (NO) are both oxides of nitrogen and together they are both referred to as NO_x. All combustion processes in air produce NO_x, although NO, a colourless gas, usually predominates. The conversion of NO to the red-brown gas NO₂ takes place in the atmosphere via reaction with chemically active species such as ozone. It is NO₂ which is associated with adverse health effects on human health. The main source of NO_x in the UK is road transport.

10A.3 Sulphur dioxide (SO₂)

10A.3.1 Sulphur dioxide (SO₂) is a gas at ambient temperature and pressure but readily dissolves in water (or rain) to give an acidic solution which is oxidised to sulphuric acid. In the UK, the predominant source of SO₂ is from the combustion of sulphur containing fossil fuels, particularly coal and heavy fuel oil, and is generally a function of the sulphur content of the fuel. SO₂ is an irritant when inhaled and can also lead to adverse effects on vegetation.

10A.3.2 SO₂ emissions have reduced significantly in the later part of the 20th century, and are currently dominated by a relatively small number of large emitters such as coal fired power stations and refineries.

10A.4 Particulate matter (PM₁₀ and PM_{2.5})

10A.4.1 Particulate Matter is generally categorised on the basis of the size of the particles (for example PM_{2.5} is particles with a diameter of less than 2.5µm). PM is made up of a wide range of materials and arises from a variety of sources. Concentrations of PM comprise primary particles emitted directly into the atmosphere from combustion sources and secondary particles formed by chemical reactions in the air. PM derives from both human-made and natural sources (such as sea spray and Saharan dust). In the UK the biggest human-made sources are stationary fuel combustion and transport.

10A.4.2 Road transport gives rise to primary particles from engine emissions, tyre and brake wear and other non-exhaust emissions. Other primary sources include quarrying, construction and non-road mobile sources. Secondary PM is formed from emissions of ammonia, sulphur dioxide and oxides of nitrogen as well as from emissions of organic compounds from both combustion sources and vegetation.

10A.4.3 Both short-term and long-term exposure to ambient levels of PM are consistently associated with respiratory and cardiovascular illness and mortality as well as other

ill-health effects. The associations are believed to be causal. PM_{10} roughly equates to the mass of particles less than 10 micrometres in diameter that are likely to be inhaled into the thoracic region of the respiratory tract. Recent reviews by the World Health Organisation (WHO) and the Committee on the Medical Effects of Air Pollutants (COMEAP) have suggested exposure to a finer fraction of particles ($PM_{2.5}$, which typically make up around two thirds of PM_{10} emissions and concentrations) give a stronger association with the observed ill-health effects, but also warn that there is evidence that the coarse fraction between ($PM_{2.5}$ - PM_{10}) also has some effects on health.