Part III
Airborne Particulate Matter: Environmental Pathways, Behaviour and Fate

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The environmental transport, behaviour and fate of airborne particulate matter (PM) generated through primary or secondary sources is highly complex and can involve a number of physicochemical, thermodynamic, hydrological, meteorological and aerodynamic processes. Knowledge regarding how PM and its various components move between environmental compartments, and the physicochemical changes they may undergo, is critical to allow for an adequate assessment of human exposures and related health risks. For example, a contaminant may be emitted in a form which is toxic to humans but may not necessarily pose a risk if transport and/or transformation mechanisms serve to reduce its environmental bioaccessibility. An understanding of the environmental fate of PM and its chemical components is fundamental to the development of sound environmental and public health policy measures and regulations, which are protective of human health. Part III contains six chapters which address various important aspects and issues related to the transport, behaviour and fate of airborne PM in the environment. These are detailed below.

In the first chapter, Balasubramanian and He review the environmental transfer and fate of semivolatile organic compounds (SVOCs) such as polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides (OCPs) and polychlorinated biphenyls (PCBs). These compounds are of concern due to their toxicity and ability to bioaccumulate and biomagnify in the environment. In the context of studies conducted in Singapore, they specifically review environmental distribution processes such as gas/particle partitioning, precipitation scavenging and air–sea exchange, which strongly govern the fate of SVOCs upon their release into environment. Kalaiarasan et al. discuss the vertical distribution of airborne PM in a tropical urban environment in the second chapter. In particular, they focus on traffic-generated, fine PM and its vertical distribution in naturally ventilated, high-rise residential buildings in Singapore, a highly dense urbanized area with little available land space for new developments to house its growing population. In the third chapter, Wei and Li discuss the gas-particle partitioning behaviour of SVOCs. In addition to examining the partitioning behaviour of PAHs and PCBs, like Balasubramanian and He, they also discuss the fate of polybrominated diphenyl

ethers (PBDEs), flame retardants which have become ubiquitous in the urban environment. Bonn details the steps and processes involved in the generation of secondary particles in urban environments in the fourth chapter. In particular, he focuses on how atmospheric trace gases (precursors) react in the gas-phase to yield particles of varying volatility and reactivity. In the fifth chapter, Ma discusses the effects of Asian dust on urban air quality in Japan, a country which receives significant airborne particulate inputs from other regions such as in China in the Spring. Using a combination of techniques to characterize the elemental composition of airborne PM and rainwater collected in Fukuoka in 2005, Ma demonstrates the importance of precipitation in the scavenging of aerosols. To conclude this chapter, Dahmani et al. detail the impacts of a pyrometallurgical facility operating in the coastal city Ghazaouet in Algeria in the sixth chapter. They describe the application of a method involving the use of sodium tetrachloromercurate to track the emission and fate of sulphur dioxide from this pyrometallurgical complex.