

## Chapter 23

# Airborne Particulate Matter: Source Scenario and Their Impact on Human Health and Environment

**Bhawna Dubey**  
Amity University, India

**Asim Kumar Pal**  
ISM, India

**Gurdeep Singh**  
ISM, India

### ABSTRACT

*Airborne particulate matter is considered to be most challenging environmental issues in the world today due to its impact on various atmospheric processes like regional and global climate change, ecosystem, agriculture and most importantly on human health in recent times. Analysis reveals that particulate matter contains various inorganic and organic compounds and biological entities and their secretions and toxic trace metals. The main regions affected are urban centers due to an increasing population, number of diverse industries, fossil fuel driven vehicles and various construction activities. The present chapter deals with the scenario of particulate matter, their sources of generation, size and their impact on human health and environment mainly in urban dwellings.*

### INTRODUCTION

Airborne small, solid particles and liquid droplets are commonly known as particulates. Ambient particulate matter (aerodynamic size varying from 1 nm to 100  $\mu\text{m}$ ) have been of much concern in present decade and has turn out to be utmost challenging environmental issues worldwide as a consequence of its impact on various atmospheric processes (regional and global climate change) and effect on human health (Charlson et al., 1992; Charlson et al., 1995; Pope et al., 1992; Baker et al., 2011). Particulate matter (PM) is treated as a vital indicator of air pollution which has carried into the air as of a diverse natural and anthropogenic source. Being smaller in size ( $\text{PM}_{10}$ ) and light weight it can travel to distant

DOI: 10.4018/978-1-5225-5487-5.ch023

area in the air and have been put under study in the past, as it can be breathed easily leading to its deposition in the respiratory system and acts as a major factor responsible for reduced lung functions and other cardio-vascular anomalies and play a crucial part in the occurrence and severity of respiratory diseases. (Alleman et al., 2010; Pope et al., 1995; Pope & Dockery, 1999; Brunekreef & Holgate, 2002). It was estimated that the direct result of air pollution and its effects on lungs and pulmonary system leads to more than two million casualties every year worldwide and it can be aggravated by the atmospheric conditions (Shah et al., 2013; Cheng et al., 2009). In comparison to more common gaseous air pollutants the human health is at more threat by the presence of PM which comprises of a divergent mixture of solid and liquid particles that varied in texture and concomitant chemicals suspended in air that keep on changing spatially and diurnally (WHO, 2013). It is found that the diverse constituents of PM contain different chemicals that includes:

- Sulphates,
- Nitrates,
- Carbon particles (elemental and organic),
- Biological compounds (e.g., endotoxin, cell fragments);
- Organic compounds (e.g., polycyclic aromatic hydrocarbons); and metals (e.g., iron, copper, nickel, zinc, and vanadium) (WHO, 2013).

Combustion of fossil fuels, industries, power plants and emissions from gasoline fueled vehicles running on roads are the primary anthropogenic causes of air pollutants in the urban air and industrial areas (Zhang et al., 2007). With the developing industry of mining, smelting and metal treatment, air pollution gets stern (Wang et al., 2001; Guo, 1994; Su et al., 1994; Wu et al., 1989; Liao, 1993). Airborne trace metals (linked with PM), are associated with several of the short-term and long-term ill effects on human health including:

- Chronic respiratory diseases,
- Heart disease,
- Lung cancer, and
- Damage to other organs (Niu et al., 2008; Williams et al., 2007; Lingard et al., 2005; Osonio-Vargas et al., 2003; Prieditis et al., 2002; Allen et al., 2001; Vincent et al., 2001; Ghio et al., 1999; Costa et al., 1997).

The present chapter discusses the sources of PM generation and its impact on human health and the environment.

## **SOURCES OF PARTICULATE MATTER**

The various sources of particulate matter can be clustered under the following categories viz., source type, emission and their spatial distribution. PM can be introduced in the air either through the direct emission from various natural and man-made sources or as conversion or by product from a gaseous precursor such as oxides of sulphur, nitrogen oxide, ammonia, and non-methane volatile organic compounds (VOCs) (Atkinson et al., 2010). Natural sources include:

20 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:

[www.igi-global.com/chapter/airborne-particulate-matter/201716](http://www.igi-global.com/chapter/airborne-particulate-matter/201716)

## Related Content

---

### Introduction to Leachate Treatment

Amin Mojiri, Siti Fatimah Binti Ramliand Wan Izatul Saadiah Binti Wan Kamar (2016). *Control and Treatment of Landfill Leachate for Sanitary Waste Disposal* (pp. 200-218).

[www.irma-international.org/chapter/introduction-to-leachate-treatment/141853](http://www.irma-international.org/chapter/introduction-to-leachate-treatment/141853)

### Integrated Management of Energy Resources in the Residential Sector Using Evolutionary Computation: A Review

Ana Soares, Álvaro Gomesand Carlos Henggeler Antunes (2015). *Soft Computing Applications for Renewable Energy and Energy Efficiency* (pp. 320-347).

[www.irma-international.org/chapter/integrated-management-of-energy-resources-in-the-residential-sector-using-evolutionary-computation/121401](http://www.irma-international.org/chapter/integrated-management-of-energy-resources-in-the-residential-sector-using-evolutionary-computation/121401)

### Ecological Condition of River Basins of Western Polesie of Ukraine

Ttiana Basiuk, Igor Gopchakand Artem Yatsyk (2023). *Handbook of Research on Improving the Natural and Ecological Conditions of the Polesie Zone* (pp. 384-401).

[www.irma-international.org/chapter/ecological-condition-of-river-basins-of-western-polesie-of-ukraine/324051](http://www.irma-international.org/chapter/ecological-condition-of-river-basins-of-western-polesie-of-ukraine/324051)

### Monitoring Changes in Urban Cover Using Landsat Satellite Images and Demographical Information

Prashant K. Srivastava, Swati Sumanand Smita Pandey (2017). *Environmental Issues Surrounding Human Overpopulation* (pp. 89-103).

[www.irma-international.org/chapter/monitoring-changes-in-urban-cover-using-landsat-satellite-images-and-demographical-information/173307](http://www.irma-international.org/chapter/monitoring-changes-in-urban-cover-using-landsat-satellite-images-and-demographical-information/173307)

### Mathematical Modeling of Economic Losses Caused by Forest Fire in Ukraine

Ivan Openko, Ruslan Tykhenko, Oleksandr Shevchenko, Oleg Tsvyakhand Yanina Stepchuk (2023). *Handbook of Research on Improving the Natural and Ecological Conditions of the Polesie Zone* (pp. 372-383).

[www.irma-international.org/chapter/mathematical-modeling-of-economic-losses-caused-by-forest-fire-in-ukraine/324050](http://www.irma-international.org/chapter/mathematical-modeling-of-economic-losses-caused-by-forest-fire-in-ukraine/324050)