Particulate systems in fire and explosion safety engineering

DoS – S Dembele, Team – K Volkov, A Heidari

Centre for Fire and Explosion Studies, School of Mechanical and Automotive Engineering

Emission of significant amounts of atmospheric aerosols, in addition to gas pollutants, negatively affects the environment in most of European countries. Aerosol emission into the atmosphere may be controlled or accidental. Large-scale industrial fires (fuel spills in fuel stores, pipelines, on ship decks, rail tankers and offshore platforms, upon plane crashes and petrochemical industrial processes) give the examples uncontrolled accidental emission of vast amount of aerosol. Fires and smoke in objects with high accumulation of occupants and difficult evacuation in case of emergency (underground halls, shopping centres, motor-car tunnels) are particularly hazardous. Probability of such events increased in recent years by threat of terrorist attacks. Forest fires and volcanic activity also supply aerosol combustion products into the atmosphere.

This project aims to quantify and to monitor aerosol emission, to assess its fire and explosion potential, and to create tools for reliable prediction of aerosol evolution and transport. The need in such a study becomes particularly evident in view of recent statistics that shows the increased frequency and severity of accidents involving hazardous aerosols. Simplified tools and techniques based on codes and standards have a limited applicability, as they are not able to represent actual complex geometry, physics and dynamics of the explosion. Computer tools have the potential to model the relevant physics and dynamics, but without relevant physical and mathematical models, choice of appropriate numerical methods, adjustment of computational parameters and proper user guidelines based on extensive validation work, very poor prediction capability can be expected. Computer modelling of the accident scenario development is able to provide reliable data of the possible pressure loads resulted from explosion process.