Seminar – Abstract

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The study of plume dispersion in an urban environment has been worthy of study since the beginning of the industrial age but more recently has become of vital importance to the daily lives of millions of people worldwide. Idealized study of this occurrence is the first step to understanding the mechanisms and variables which control the dispersion of industrial contaminants from smokestacks as well as truck and train spillages upwind or within an urban environment. With modern capabilities for creating toxic chemicals, the demonstrated willingness of terrorists to unleash them, and the high population density within urban environments such as New York and London make the paths followed by and concentrations of released toxins a necessity to better understand. It should also be noted that the beginning of epidemics such as airborne viruses may be studied using these methods with suitable alterations in approximating the initial release of these pathogens. These issues are discussed in further depth within Settles (2006). Past studies have collectively given us a thorough understanding of plume dispersion over sufficiently (flat, homogenous, unobstructed) nice terrain (Pasquil, 1983). The techniques developed for those situations provide a nice basis for further work but don't adequately predict velocity or dispersion statistics for terrain containing obstacles (Gailis and Hill, 2006 ; Yee et al., 2006). Plume dispersion upwind of a large obstacle or small group of obstacles has been studied by Meroney (1985) and Hosker (1984,1985) and found useful for understanding flow fields about obstacles but not as a realistic representation of an urban environment. Davidson et al. (1995, 1996) and McDonald et al. (1996,1998) used both field trials and wind tunnel experiments to investigate plume dispersion within an array of cubic obstacles. They concluded dispersive characteristics within the array were highly dependent on the initial plume size, the width to height ratio of the obstacles, and the gap distance in the windward direction. These results were later verified and expanded upon through the study of obstacles with a more realistic width to height ratio for an urban environment by Yee et al. (2006) and Gailis and Hill (2006). We propose that the effect of stratification may play a large role in the dispersion of contaminants within an urban environment. Previous testing was extremely limited and the results were questioned by the authors themselves, as such there is a need for future work to focus on understanding the effect of mildly stable atmospheric stratification on dispersion and turbulent intensities.