

Health risk from vehicle emissions and soot in urban area

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Increased emissions through the 'stop and go' at traffic junctions in combination with surrounding buildings may lead to accumulation of pollutants and multiply the harmful impact on human health. Inhalation is the major route of exposure to benzene and fine soot particles in cities.

The microscale model MIMO (developed at the Department of Technical Thermodynamics, University of Karlsruhe and described by Winkler, 1995 and Erhard *et al.*, 2000) was applied for simulation the dispersion of inert gases and fine aerosols (soot) under different wind regimes. The simulation was based on the common rules which govern wind flow and dispersion in built up areas. However, a different approach to urban air pollution modeling was developed. At first, we concentrated on long term means (monthly). Secondly, we determined the most polluted zones which arise and persist stationary as a result of air flow around buildings near the traffic junction. Samples were exposed to air pollution for one month, thus finally the model results have been weighed according to wind rose in that time.

At the beginning, a GIS-spatial data base was created in which the results from measurements campaigns were included. The simulation region is located near the main traffic junction at Square Legionów, in the center of Wrocław. Wrocław is situated in southwestern Poland, it has ca. 720 000 inhabitants.

There were 827 point sources, each in a mesh of 3×3 m, the total length of a line source about 2500 m. Typical emission scenarios for heavy traffic roads is presented in Table 1, hence total soot emission should be 10 mg/s or 36000 mg/h. For the evaluation run a value of 3000 mg/h has been used. As for an example, the spatial soot concentrations for east wind conditions are presented in Figure 1.

The spatial analysis confirmed that concentrations of vehicle pollutants are not homogeneously distributed along street canyons and also impact on backyards. This method could be used for evaluation of urban inhabitants exposure to vehicle emissions and thus it seems to be an effective tool for urban management.

Table1. Typical emission scenarios and values for heavy traffic roads.

	Benzene	Soot
Emission factor [g/kg/PKW]	0.3	0,015 automobiles 0,3 trucks
Emission density [mg/m/s]	0.006	0.004
Avg. of a polluted road [µg/m ³]	4.1 – 6.5	3.0 – 4.9

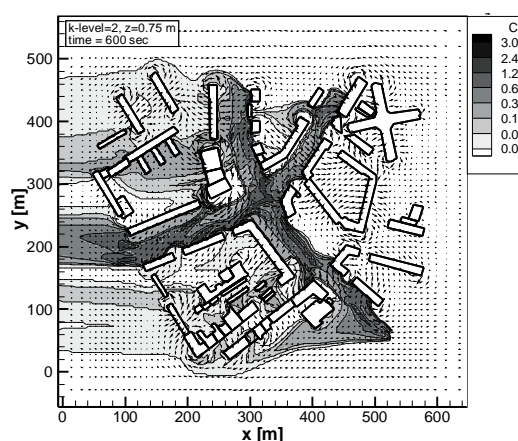


Figure 1. The wind field and spatial soot concentration distribution for east wind conditions.

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