Modeling Exposures to VOCs via an Individual-Based Approach Part II:
Application to an “Air Toxic Hot-Spot” Area in Camden, NJ

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Abstract
An Individual Based Exposure Modeling (IBEM) application of the MENTOR-1A system was completed for an “air toxic hot-spot” area in Camden, NJ to characterize ambient and personal exposure levels for two air toxics (benzene and toluene). The IBEM application of the MENTOR-1A system used subject-specific information collected from the field study, such as demographic, housing characteristics, time-activity patterns, etc., to estimate personal exposures in the framework of a source-to-exposure sequence. The emissions-based ambient concentration estimates of air toxics at the residence of each subject were calculated using atmospheric dispersion models, specifically the Industrial Source Complex Short Term Version 3 (ISCT3) and the AMS/EPA Regulatory Model (AERMOD). Calculated outdoor concentrations, and those measured during the study were then combined with information from activity diaries completed by the subject as inputs to the MENTOR-1A system for estimating personal exposures resulting from outdoor sources. The modeling results were compared to the measurements of neighborhood and personal air concentrations collected in a field study for model evaluation. The MENTOR-IBEM approach involved the use of local ambient concentrations and subject-specific time-activity pattern data to estimate the percentage contributions of air toxics to personal exposures resulting from ambient sources. This approach facilitated the interpretation of factors such as location, day-of-the-week, and seasonal effects on personal exposure measurements.

Objectives
The aims of this study were to:
(a) Conduct an IBEM application of the MENTOR-1A system for a “hot spot” area in Camden, NJ and evaluate the viability of the IBEM application by comparing modeling results with ambient and personal measurements collected from the field study;
(b) Characterize the impact of local industrial and mobile air toxics sources on personal exposures and local air pollution in the area of Camden, NJ; and
(c) Establish the refinements necessary for applying the modeling tools of the MENTOR system for future population exposure and health assessments in “hot spot” areas.

Approach
The IBEM implementation of MENTOR-1A was exercised for each of the 108 subjects living in Waterfront South (WFS) and Copewood/Davis Streets (CDS) of Camden, New Jersey (NJ) during the study period from 2004 to 2006. The generalized 7-step approach of MENTOR-1A, accounting for the processes determining exposures/doses from source-to-dose, is employed in this study (see the flowchart in Part I).

Geographic Location of Study Area
The geographic locations of the subjects’ homes in the neighborhoods of Waterfront South (WFS) and Copewood/Davis Streets (CDS) in Camden, NJ are shown in (a). The emission modeling domain, including all the census tracts located within the 25km radius from the geographical center of the sampling homes in Camden, NJ is shown in (b).

Conclusions
The IBEM implementation of MENTOR-1A was applied to a “hot-spot” area in Camden, NJ for characterizing ambient and personal exposure levels for two air toxics (benzene and toluene). Model predictions were evaluated against ambient and personal measurements collected in the field study. The evaluation results provide insights and identify limitations and data gaps in applying the MENTOR-IBEM approach to “hot-spot” areas. The MENTOR-IBEM approach demonstrated in this study involves the use of local ambient concentrations and subject-specific time-activity pattern data to estimate the percentage contributions of air toxics to personal exposures resulting from ambient sources, which has not been pursued in previous studies. This approach has been applied in this study to characterize the impacts of local ambient concentrations on personal exposure levels and also to facilitate the interpretation of location, day-of-the-week, and seasonal effects on the personal measurements.

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