Session: 6 Paper Number: 79

Investigating Principles of Workroom Exposure

C.E. Feigley (1), J. Khan (2), E. Lee (1), M. Ahmed (2), S. Tamanna (2), R.O. Semeniuc (1), J.J. Jenkins (1)

(1) Department of Environmental Health Sciences, Arnold School of Public Health, Rm. 311, University of South Carolina, Columbia, SC 29208, (2) Department of Mechanical Engineering, University of South Carolina

The ability to estimate worker exposure accurately is essential for evaluating workplace hazards and protecting workers. However, exposure assessment is often the weakest element in research examining the relationship between contaminant exposure and occupational disease. Thus, improving the performance of exposure estimation methods is extremely important. Here experimental and mathematical methods were used to explore important determinants of exposure to airborne contaminants, particularly worker presence and activity. All aspects of this research address the inherent challenge presented by the variation of workroom concentration with time and location.

Three-dimensional tracer gas distribution patterns have been observed in a chamber (0.21 m3) and an experimental room (19.2 m3) under isothermal and nonisothermal conditions, and in the presence and the absence of worker surrogates. Computational fluid dynamic (CFD) methods were tested against observations and used to investigate: the effects of dilution air flowrate; the impact of inlet, outlet, and source locations; and the performance of simple deterministic models.

For three of four flowrate-location combinations, a stationary worker near the tracer gas source was exposed to higher concentrations than the concentrations observed at that location when no worker was present. Average exposures were higher when the worker was facing the source. The tracer concentration encountered by a worker moving along a fixed path and the concentration along that path when no worker was present differed by less than 5%. These findings were similar for different air flowrates and for both isothermal and nonisothermal conditions.

Measured and simulated concentration distributions for various room configurations and conditions were used to evaluate the performance of three deterministic models, near to and far from the source. Of the models evaluated, the simple box model was judged to be the best for use in occupational epidemiology because it had the lowest absolute error and the least variable error. The two-zone box model was the best for protecting workers and for compliance determination because it moderately overestimated exposures close to the source, providing an additional safety margin.

NORA Symposium 2003

Working Partnerships: Applying Research To Practice

June 23-24, 2003

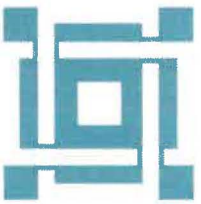
Hilton Crystal City Hotel
Arlington, VA

CDC Workplace Safety and Health

NIOSH

APHA

NORA Symposium 2003



Working Partnerships: Applying Research To Practice

June 23-24, 2003