Not just radon: the intrusion of contaminants from the subsurface into indoor air

Jill Johnston

PhD Candidate, ESE

Wednesday, October 10, 2012

133 Rosenau Hall

12:00 - 12:50 p.m.

Abstract

Although the U.S. Congress has enacted numerous important environmental laws over the past forty years, these laws largely ignore the indoor sphere, even though Americans spend up to 90% of their time indoors. While it is well known that radon gas can enter homes and pollute the air, relatively little is known about the movement of subsurface contaminants in the soil or groundwater and into indoor air. This phenomenon, called vapor intrusion, is a potentially important exposure pathway for residents living at or near hazardous waste sites, particularly those contaminated with a class of chemicals called chlorinated volatile organic compounds (CVOCs). Current regulatory guidance is limited in scope, and robust decision-making tools for managing vapor intrusion risks are lacking. Using an environmental justice community in San Antonio as a case study, alternative approaches of modeling and monitoring to estimate community-wide exposures and to inform regulatory tools for addressing vapor intrusion are evaluated.

First, a probabilistic-based house-by-house model was developed to estimate indoor air concentrations of CVOCs in 31,100 homes in the community in San Antonio based on the Johnson-Ettinger algorithm. Characterizing the variability and uncertainty in model input variables, a Monte Carlo simulation was used to predict CVOC concentrations in indoor air. The mean estimated values underpredicted indoor concentrations by roughly the same amount in each home where indoor concentrations were measured, and the 95th percentile estimate better reflected actual values. Next, to better understand sources of spatio-temporal variability, a longitudinal study of indoor air was conducted using passive sampling techniques to measure changes in indoor air concentrations of CVOCs due to vapor intrusion. A regression analysis found that barometric pressure drops, calm wind speed, and high temperatures increased vapor intrusion. Closed windows and crawl space foundations also were associated with higher indoor air CVOC concentration. This exposure model will be combined with site-specific data with the aim of calibrating a tool to better characterize the current and historic CVOC exposure due to vapor intrusion.