Proposed Tools and Approach for Ground-Water Vulnerability Assessment (GWAVA) Using a Geographic Information System and Simulation Modeling

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Over the past two decades, many different tools have been employed to predict the likelihood of detecting surface-derived contaminants in ground water, including (1) scoring methods to rate the relative tendencies of different site characteristics to facilitate contaminant movement to (and within) ground water, (2) statistical relations between contaminant occurrence and site-based parameters, and (3) computer simulations of contaminant fate and/or transport in the subsurface (vadose zone and ground water). To date, most of the ground-water vulnerability assessments (GWAVAs) conducted for the U.S. Geological Survey's National Water-Quality Assessment (NAWQA) program have used regression equations, neural networks and other statistical relations to predict (or explain) contaminant occurrence in ground water from estimates of contaminant loading and other site-specific parameters.

Recent work, however, has led to the development of a variety of methods that can be used to conduct GWAVAs using numerical simulations of contaminant transport and fate in the subsurface. This discussion will present a proposed approach for assembling several of these tools into a system to predict the concentrations of surface-derived compounds in ground water anywhere in the conterminous United States. For a well of a specified location and depth, the approach uses a geographical information system and simulation models to: (1) delineate the most likely zone(s) of contribution to the well, (2) assemble the input data required for simulating the transport and fate of the contaminant of interest in the subsurface beneath the inferred zone(s) of contribution, (3) simulate the transport and fate of the contaminant within the vadose zone, and (4) simulate the transport and fate of the contaminant as it moves from the water table to the well screen. The accuracy of the predictions will be evaluated for selected pesticides by comparing predicted concentrations with those measured in ground water at a subset of the nearly 5,200 wells sampled by NAWQA between 1992 and 2001.