THE EFFECT OF MACRO-KINETIC SOLUTES ON HUMAN HEALTH RISK WITH TIME-DEPENDENT EXPOSURE

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The uncertainty associated with quantifying the environmental concentration (for example, groundwater concentration at a well) used to assess human health risk is substantial, and is often a driver if remediation is needed. Traditionally risk is based on the point of maximum environmental concentration, and is independent of time. We present a new formulation that relaxes this assumption to investigate how time other time dependent variables in human health risk may affect the overall assessment. As recommended by the US EPA Risk Assessment Guidance for Superfund (RAGS) and other regulatory documents, the environmental concentration implemented when calculating exposure is the maximum average concentration of the breakthrough curve over the exposure duration (ED). T he ED is meant to represent the true interaction time between an individual and the contaminant, although a suggested thirty-year standard is often implemented. This standard may not be representative in all risk assessments because the actual ED may be shorter, longer, or may vary intermittently. An accurate assessment of risk is further complicated if exposure time varies as a function of time, where a singular assessment of risk (i.e. a singular ED window) is used. Previous studies found shorter exposure durations more accurately characterize concentration fluctuations (and result in a larger environmental concentration) but argue that because exposure increases linearly with ED, the calculated exposure and therefore risk are also smaller, diminishing the overall need for smaller a ED. To further investigate these interactions, this study utilizes a nested, or t wo-step, Monte Carlo scheme, explicitly considering joint uncertainty and individual variability (JUV). The advantage of a JUV approach is that the propagation of unc ertainty from environmental conditions (i.e. geo-hydrologic conditions and numerical modeling assumptions) and how uncertainty relates to the probability of risk can be quantified. Ensembles of kinetic solutes (i.e. reaction rate dependent) and equilibrium solutes (reaction rate independent) are utilized to further compare the time dependence with a systematic sensitivity analysis of varying sizes of stationary ED windows. Results of this study have implications in the assessment of risk when steady state conditions cannot be assumed, and illustrates the importance of fundamental assumptions in risk assessment studies.