GROUND WATER CONTAMINATION BY DBCP AND TCP IN HAWAII AND CALIFORNIA: PART 1. UNSATURATED ZONE

Nematode infestation can be devastating for a variety of crops, including pineapples, tomatoes, peppers, sweet potatoes, and strawberries. Soil fumigants have been used to control this important class of pests, including those with the active ingredient 1,2-dibromo-3-chloropropane (DBCP) and the impurity 1,2,3-trichloropropane (TCP). Ground water was contaminated with DBCP and TCP following application to pineapple fields on Maui, and TCP was found in ground water in southern California following application to the other four crops. Two teams worked together in a 'double blind' approach to model the front end – pesticide application and movement through the root zone – independent of the saturated zone modeling, and without review of monitoring results. Site-specific meteorological files were constructed. Historic pesticide use records were available for Maui, and a combination of historic aerial photographs, grower interviews, and product labels were used to construct pesticide use records for the California fields. Soils at both sites were sampled and analyzed for properties relevant to retention of water and pesticides. Site-specific environmental chemistry parameters were estimated, mostly based on empirical data – hydrolysis rate constants, Koc values, diffusion coefficients, etc. Fluid flux and contaminant concentration output from the EPA's Pesticide Root Zone Model (PRZM) was entered into HYDRUS-1D, which simulated vadose contaminant migration below the root zone. HYDRUS-1D produced contaminant flux at the water table which became a boundary condition for a ground water flow and transport model using MODFLOW-2000 and MT3D. Saturated zone modeling will be described in Part 2 of this presentation. Contaminant breakthrough predictions at production wells were compared with all available monitoring results at both locations. Minimal model calibration was needed to obtain excellent agreement between predicted and observed concentrations.

GROUND WATER CONTAMINATION BY DBCP AND TCP IN HAWAII AND CALIFORNIA: PART 2. SATURATED ZONE FLOW AND TRANSPORT MODEL

Nematode infestation can be devastating for a variety of crops, including pineapples, tomatoes, peppers, sweet potatoes, and strawberries. Soil fumigants have been used to control this important class of pests, including those with the active ingredient 1,2-dibromo-3-chloropropane (DBCP) and the impurity 1,2,3-trichloropropane (TCP). Ground water was contaminated with DBCP and TCP following application to pineapple fields on Maui, and TCP was found in ground water in Oceanside, California following application to the other four crops. Two teams worked together in a 'double blind' approach to model the front end – pesticide application and movement through the root zone – independent of the saturated zone modeling, and without review of monitoring results (Part 1 of this presentation). Site-specific meteorological and pesticide use files were constructed. Soils at both sites were sampled and analyzed for properties relevant to retention of water and pesticides. Site-specific environmental chemistry parameters were estimated, mostly based on empirical data – hydrolysis rate constants, Koc values, dispersion and diffusion coefficients. Output from the EPA's Pesticide Root Zone Model (PRZM) was entered into HYDRUS-1D, and output from the latter was used as contaminant transport input into MT3D. Ground water flow was modeled with MODFLOW-2000. Contaminant breakthrough predictions at production wells were compared with all available monitoring results at both locations. Minimal model calibration was needed to obtain excellent agreement between predicted and observed concentrations. Models at both the Maui and Oceanside sites show that when models are prepared with accurate source term data, site-specific soil and aquifer parameters and accurate chemical data, well-calibrated models can be created that are capable of excellent backcasting, and can be relied upon for predictive modeling efforts into the future.

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