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USE OF SIMULATED TRAVEL-TIME DISTRIBUTIONS TO ENHANCE UNDERSTANDING OF WATER QUALITY IN PUBLIC-SUPPLY WELLS

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ABSTRACT: As part of the National Water Quality Assessment program, the U.S. Geological Survey analyzed untreated water samples from 27 public-supply wells in the southern New Jersey Coastal Plain for a wide range of compounds in 1998 and 2009. A groundwater-flow model was constructed and calibrated to heads, head gradients, baseflows in streams, and concentrations of sulfur hexafluoride and tritium to increase understanding of the areas contributing recharge and travel-time distributions for the wells and the relation of those to the water quality and how it might change. Results show that the wells have varying travel-time distributions in general ranging between 10 and 100 years. The distributions together with increasing urbanization in the areas contributing recharge indicate an increasing urban signature in the wells. Chloride concentrations increased in all 27 wells between 1998 and 2009 which is consistent with observations from shallow monitoring wells and surface water base flow in urban areas of the watershed. Although the chloride concentrations are not near drinking-water standards, the change indicates an increasing influence of urban land use on these wells. From 1998 to 2009, mean concentrations and detection frequencies increased for methyl tert-butyl ether (MTBE, a gasoline additive used until about 2006) and dieldrin (a pesticide that was banned in 1986). The persistence of these chemicals in wells even after the compounds were no longer used is consistent with a time lag in the system indicated by the groundwater modeling. Two other compounds of concern, radium and mercury, both have natural sources in the aquifer and in soil; however, results of human activity that change overall geochemistry (acidification, nitrification, increase in dissolved solids, chloride, and redox-sensitive chemical species) appears to increase their mobility in the aquifer, resulting in concentrations near or above the drinking water standards in many of the untreated samples.

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