Errata Sheet (EPA/625/R-02/005)

DISTRIBUTION OF MERCURY IN SHALLOW GROUND WATER OF THE NEW JERSEY COASTAL PLAIN AND A POSSIBLE MECHANISM OF TRANSPORT

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More than 400 domestic wells that tap the major unconfined aquifer in 72 areas in New Jersey's Coastal Plain have yielded water containing total mercury at concentrations exceeding the maximum contaminant level (MCL) of 2 µg/L. Concentrations of mercury in the aquifer typically are less than 0.01 µg/L. Additional water-quality data collected at several of these contaminated areas indicate that concentrations of chloride and nitrate also are elevated.

In a regional study conducted by the U.S. Geological Survey in cooperation with the New Jersey Department of Environmental Protection, 126 domestic and observation wells in different land-use areas and 28 clustered observation wells in undeveloped and agricultural land were sampled. Mercury concentrations typically were less than 0.01 µg/L in filtered (0.45-µm pore size) samples, but tended to increase with concentrations of chloride (and other constituents), indicating that mercury may be transported as a chloride complex. Concentrations of mercury >0.1 µg/L did not correlate with concentrations of other constituents, however, indicating that mercury near and at the MCL may not be transported in the same chemical form as mercury at lower concentrations. Mercury concentrations > 1 µg/L typically are associated with residential land use, but such high concentrations have not been found in water underlying undeveloped land. The distribution of these elevated mercury concentrations appears to be "spotty" at both the regional and neighborhood scales, as the presence of extensive plumes of mercury-contaminated ground water could not be demonstrated.

In a related study of 31 observation and domestic wells in one residential area, 14 domestic wells yielding mercury-contaminated water were resampled; mercury concentrations in filtered samples were much smaller (<0.1 to 3.1 µg/L) than those in previously collected unfiltered samples (2.0 to 15 µg/L), indicating that much of the mercury present is adsorbed to particulate and colloidal material. Mercury concentrations were lower and mercury commonly was more evenly distributed in the soil profile of residential soils than in adjacent undisturbed forest soils in the area. The depletion of mercury in the residential soils likely indicates that mercury has been mobilized and transported from these soils to ground water. Detections of surfactants, ammonia, and sulfide, and high sodium and chloride concentrations (up to 59 and 89 mg/L, respectively) in water from many of the 31 wells likely indicate that septic-system effluent has affected water quality; this may provide a geochemical environment conducive to mercury mobilization.

On the basis of results from these studies, a four-part hypothesis is advanced regarding mercury transport in shallow ground water. (1) Mercury has been contributed to soils by atmospheric deposition and historical use of mercurial pesticides. (2) Mercury is mobilized from soils by disturbance during development activities. (3) Septic-system effluent provides sulfur-rich organic matter to bind mercury to organic colloids or particles and surfactants to promote colloid mobility. (4) Periodic surges in well pumping increase interstitial pore-water velocity, enhancing mobility and capture of colloids by wells. This preliminary model may be applicable throughout much of southern New Jersey, as other residential areas with mercury-contaminated ground water typically are unsewered housing developments. A research program to evaluate this hypothesis is under development.