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PREDICTED ARSENIC CONCENTRATIONS IN BASIN-FILL AQUIFERS IN THE SOUTHWEST

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ABSTRACT: In 2001 the U.S. Environmental Protection Agency lowered the drinking-water standard for arsenic from 50 to 10 $\mu\text{g/L}$, generating renewed interest in the distribution of arsenic concentrations in drinking-water supplies throughout the United States. A preliminary statistical-based (random forest classifier) model was developed to characterize the distribution of arsenic concentrations in groundwater in basin-fill aquifers of the Southwest. The model incorporated both natural and human-related factors affecting arsenic concentrations in groundwater and was calibrated in areas with known groundwater arsenic concentrations. Model predictions were extrapolated into areas where arsenic concentration data are currently unavailable. The predicted distribution of arsenic concentrations in groundwater throughout the basin-fill aquifers was developed using variables representing arsenic sources and aquifer characteristics and geochemical conditions. Factors particularly important in predicting arsenic concentrations were geochemical conditions (primarily pH and redox conditions), rock type adjacent to the alluvial basin, general position of sample along a flow path relative to recharge and discharge areas of the groundwater flow system, natural recharge rates from precipitation, and groundwater discharge processes. Predicted arsenic concentrations were higher in basins where basin-fill sediments were derived from volcanic and(or) crystalline bedrock and lower in basin-fill aquifers predominately derived from carbonate and(or) clastic sedimentary bedrock. Arsenic concentrations increase in groundwater as it flows from basin margins to topographically low areas within a basin, indicating the importance of geochemical reactions that enrich arsenic along the flow path, especially those of long length. Preliminary model results indicate that about 43 percent of the area where basin-fill exists within the Southwest is predicted to contain groundwater with concentrations of arsenic that may exceed 10 $\mu\text{g/L}$. Most of the area with high concentrations is within the western portion of the Basin and Range Physiographic Province that includes parts of Nevada, California, and Arizona. Given the presence of geologic sources, arid/semiarid nature of the area, and prevalence of closed basins, groundwater of the Basin and Range is particularly susceptible to arsenic enrichment. Geochemical characteristics of the basin-fill aquifers in the Basin and Range as a whole, as well as other parts of the Southwest, generally favor arsenic transport in many areas.

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