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Nitrate in the Summit Valley of Southwest Montana

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ABSTRACT

The Montana Ground-Water Assessment Program is completing fieldwork in the upper Clark Fork drainage basin. Preliminary ground-water sampling results from the Summit Valley (Butte area) revealed elevated nitrate concentrations (greater than 2.0 mg/L) in the alluvial and bedrock aquifers. A review of the valley's recent and historic ground-water analyses obtained from the Ground-Water Information Center database shows that 64 percent (96 out of 149) of the samples had nitrate concentrations greater background (2.0 mg/L) and 15 percent (22 out of 149) of the samples exceed the 10.0 mg/L health standard. Elevated nitrate concentrations were detected below sewered urban/residential areas, and unsewered residential areas as well as in shallow (less than 50 feet deep) wells and deep (greater than 200 feet deep) wells. Sampling of Blacktail and Silver Bow Creeks, the primary surface water drainages in the valley, during base flow conditions in November of 2001 showed that concentrations of nitrate exceeded 1.0 mg/L over a 5-mile stretch through the most densely populated part of the valley. The results indicate that the elevated nitrate in the ground water clearly impacts the surface water in the valley during low-flow conditions. However, nitrate was not detected in the farthest downstream surface water sample, which was obtained directly below the wastewater treatment plant outfall.

To assist with source identification, ground-water samples were collected from fourteen wells in different aquifers and land use settings for analysis of stable isotopes of nitrogen and oxygen. Different sources of nitrate (NO_3) can have isotopically distinct nitrogen ($\delta^{15}\text{N}$) and oxygen ($\delta^{18}\text{O}$). The results showed that the nitrate in all the samples had a similar isotopic signature. The $\delta^{15}\text{N}$ values ranged between 4 and 12 per mill, while the $\delta^{18}\text{O}$ (of the NO_3) values ranged between -4 and 2 per mill. The measured $\delta^{15}\text{N}$ and $\delta^{18}\text{O}$ values are not consistent with a fertilizer source for the nitrate, however they are suggestive of animal or septic waste sources.