2005 Salt Lake City Annual Meeting (October 16–19, 2005)

Paper No. 107-8

Presentation Time: 4:00 PM-4:15 PM

EFFECTS OF WELL OPERATION ON QUALITY OF WATER FROM A PUBLIC-SUPPLY WELL IN MODESTO, CALIFORNIA

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Many cities in the eastern San Joaquin Valley, California, rely on ground water for drinking-water supply. Recharge from irrigated agriculture, along with ground-water pumping in urban and agricultural areas, influence the rate of movement of contaminants in the aquifer. A better understanding of the movement of contaminants to public-supply wells and the effects of well operation practices on water quality is needed to help reduce the vulnerability of the water supply.

A regional ground-water flow model was used to approximate the distribution of water flowing into a public-supply well in Modesto, California, as part of a USGS study of movement of natural and anthropogenic contaminants to public-supply wells. Twenty-three monitoring wells were installed within the 100-year zone of contribution to the public-supply well and were sampled for a suite of constituents, including uranium and nitrate. In addition, well-bore flow was measured and water-quality samples were collected at different depths in the public-supply well under pumping conditions.

Although only about 15 percent of the pumped water is from the shallow part of the aquifer, uranium and nitrate concentrations are high. Uranium exceeds the drinking-water standard in the public-supply well during the winter months. The high uranium concentrations in the well are likely caused by downward flow in the well-bore and out into the aquifer when water is not being pumped. The poor quality water is stored temporarily in the adjacent aquifer and is pumped out at early pumping times. Longer periods of pumping during winter months will help mitigate the non-compliance with drinking water standards.

However, the long-term sustainability of this drinking-water supply will be affected by an increasing proportion of high-alkalinity, oxygenated water from the shallow part of the aquifer, which mobilizes natural uranium from the sediments as the water moves downward through the aquifer. Nitrate concentrations also are expected to increase, although the low input concentrations of nitrate beneath the urban area may mitigate, through dilution, the high nitrate input from agricultural areas. Ground-water flow and transport simulations of the movement of solutes to the public-supply well will help determine the long term vulnerability of the water supply.

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General Information for this Meeting

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