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FOR IMMEDIATE RELEASE
June 21, 2006
NR-06-06-06



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LAB STUDY PINPOINTS NITRATE SOURCES IN VALLEY GROUNDWATER

LIVERMORE, Ca. -- Using a method of combining chemical and isotopic tracers, a team of scientists from Lawrence Livermore National Laboratory (LLNL) has completed a study that helps pinpoint the sources of nitrate in the Tri-Valley's groundwater supply. The study took place on a portion of the Valley's groundwater basin, which is managed by the Zone 7 Water Agency.

The study, which is reported in the latest edition of *Applied Geochemistry*, is part of the Groundwater Ambient Monitoring and Assessment (GAMA) project, a partnership between LLNL, the U.S. Geological Survey, and the State of California to study groundwater contamination throughout the state.

According to the California Department of Health Services, nitrate is the most common contaminant found in state groundwater and presents a serious threat to the state's supply. In many groundwater basins, increasing urbanization has created a growing demand for drinking water, while long histories of agricultural activity have left aquifers potentially at risk from nitrate contamination.

The study determined that contamination due to animal waste (including seepage from septic systems) has decreased over the past two decades, and that synthetic fertilizer is increasing as a source of nitrate contamination in the Valley's groundwater. The study also concluded that naturally occurring nitrogen in soil is the most likely source of high background levels of nitrate in basin groundwater. Nitrate contamination can come from application of synthetic fertilizer, confined animal operations, septic system discharge, or oxidation of soil nitrogen.

"As more and more rural areas in California are developed into cities, sources of viable drinking water become a cause for concern. These studies

provide valuable information for water managers to determine what can be used as a water source,” said Jean Moran, a chemist and project leader for LLNL’s involvement in GAMA. Moran and Brad Esser, the scientific capability leader for environmental radiochemistry, led the study.

“It wasn’t so long ago that the Livermore-Amador Valley was an agricultural hub,” explained Matt Katen, who leads Zone 7’s groundwater protection program. “As the region continues to evolve into an increasingly urban area, we need to stay one step ahead in understanding potential sources of groundwater contamination. This study will help us do that.”

To determine contamination sources, Moran, Esser and colleagues combined nitrate isotope data with other isotopic tracers such as tritium and the isotopic composition of water to provide insight into the routes and timing of nitrate in the groundwater. Stable isotopes provide information about water sources, while tritium-age dating defines groundwater residence times and transport behavior. In addition, dissolved gas and nitrate isotope evidence indicates that nitrate moves conservatively in the basin’s groundwater, which simplifies source attribution. Based on these data, the team could determine whether the nitrate came from a waste water source (such as manure or septic system discharge) or a synthetic source (such as inorganic fertilizer).

The study makes no recommendations, yet its findings will be used as the state and other water agencies determine future courses of action. The same group of LLNL scientists will carry out a detailed study of discharge from septic systems in Livermore this summer, in cooperation with Zone 7 and the State of California.

“These methods can be widely applied to other regions with historical nitrate inputs and can provide valuable information in evaluating future migration strategies,” Moran said.

As the Valley’s water supply wholesaler, one of Zone 7’s primary missions is to manage the groundwater basin to maintain its viability as a source of drinking water and to protect it from any potential damage. The Valley’s groundwater basin plays a critical role in Zone 7’s water supply responsibilities, supplying up to 25 percent of the Valley’s annual water needs. With a capacity of 250,000 acre feet, the agency also uses the groundwater basin to store water in the event of a prolonged drought. Zone 7 recharges the

groundwater basin naturally with rainfall and artificially with surface water imported from the Bay/Delta.

Zone 7 supplies treated water to more than 190,000 people via four water retailers: the cities of Pleasanton and Livermore, the Dublin San Ramon Services District, and the California Water Service Company, and supplies untreated water to agricultural customers. All of Zone 7's water, no matter the source, meets the state and federal limits for a safe drinking water supply.

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