Session M5: Contamination of Drinking Water Supplies

Room B111-112
10:00 – 11:30 am

0107
M5-1

Well Assessment Decision Support System – A Web Tool for Evaluating the Vulnerability of Public-Supply Wells

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Better understanding of the factors that affect public-supply well vulnerability to contaminants in groundwater is an important piece of the economical delivery of drinking water. While tools are currently available to assist public- supply managers with delineation of the contributing area for their wells, there are other important factors that affect the vulnerability of public-supply wells to different contaminants. A study of public-supply well vulnerability to contaminants in groundwater, conducted by the National Water-Quality Assessment (NAWQA) Program of the US Geological Survey from 2001 to 2011, identified four factors that are integral for understanding current quality and anticipating future quality of water produced by public-supply wells.

The four factors identified are sources of recharge and contaminants associated with those sources, geochemical conditions of water in the aquifer and well, the groundwater age mixture of water withdrawn by the well and the presence of preferential flow pathways. Collectively, the information pertaining to these factors can help determine which contaminants in an aquifer may reach a public-supply well, and when, how and at what concentration they might arrive. The purpose of the Well Assessment Decision Support System is to guide public-supply managers through the process of quantifying the effect of the four factors in their well, using online checklists and linked toolsets. The summary report generated based on the information a water-supply manager provides about their system then provides insight on the relative vulnerability of their public-supply well. It also provides guidance on analyses that could help better quantify the vulnerability of their specific system.

0451
M5-2

Investigating the Source of Nitrate in a Salinas Valley Drinking Water Supply Well with Isotopic Tracers

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Nitrate contamination is pervasive in groundwater systems throughout California including the Salinas Valley. The local nitrate problem is because the Salinas Valley area has been an agricultural center for centuries. The valley relies heavily on groundwater for domestic purposes as well as for irrigation. The San Jerardo farming cooperative community has relied solely on groundwater for all its needs and had struggled with elevated nitrate concentrations in its water supply for decades. The nitrate-impacted drinking water supply well in this small agricultural labor co- operative community had been warranted unsafe for human consumption because nitrate concentrations were well above the MCL. A new water supply has recently replaced the former well. The former drinking water supply well, located in the Salinas Valley Groundwater Basin - Eastside Sub-basin, was completed at a depth of 450 ft. under semi-confined conditions of the alluvial Paso Robles Formation.

One of the goals of the study is to unravel the complex dynamics associated with local and regional source loading, recharge, and discharge, and make a definitive statement about the source of the nitrate contamination in order to recommend best management practices into the future. This study implements an interdisciplinary approach to investigate the source of nitrate. Stable isotope ratios of water (δ^2H, δ^{18} O- H^2O) and nitrate (δ^{15} N, $\delta 1^8O$-NO_3) were analyzed as source indicators. Additionally the study utilized dissolved oxygen content, dissolved nitrogen and argon gas concentrations, selected anions (F^-, Cl^-, NO_2^-, Br^-, NO_3^-, SO_4^{2-}), and tritium-helium groundwater age-dating to examine the processes taking place in the subsurface. A high-resolution time-series dataset of pumping volumes and nitrate concentrations also provided invaluable insight into the changes in nitrate concentration that are observed seasonally.

0485
M5-3

Solar Powered Mixers' Effects on Nitrate, Nitrite, Phosphate, and TKN Concentrations in a Drinking Water Reservoir

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Birmingham Water Works Board (BWWB) has recently installed solar mixing devices in one of its primary drinking water sources, Lake Purdy. The purpose of these mixers is to improve the quality of the raw water before treatment. The BWWB has collected samples for several parameters, at various depths, before and after the activation of the mixers.

The BWWB is particularly interested in the effects the mixers have on nutrient concentrations in the reservoir. The BWWB measured concentrations of nitrate, nitrite, total phosphate, and total Kjeldahl nitrogen, (TKN) before and after the mixers' installation. Samples were collected from near surface to thirty feet below Lake Purdy. Other parameters such as pH, dissolved oxygen, and oxidation -reduction potential (ORP) have also been sampled. The comparison of the data will likely indicate if the mixers have, in their first months of operation, significantly changed the lake's chemistry with regard to nutrient concentrations.

0505
M5-4

Groundwater Quality in the San Fernando-San Gabriel Groundwater Basins, CA

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Groundwater quality in the ~1,200 km<sup>2<sup> San Fernando-San Gabriel groundwater basins was investigated as part of the Priority Basin Project of the GAMA Program, a collaboration of the California State Water Resources Control Board, US Geological Survey and Lawrence Livermore National Laboratory. Samples from 52 wells were analyzed for water chemistry, isotopic abundances, and dissolved gases. The study, designed to provide a spatially unbiased assessment of untreated groundwater quality in the primary aquifer systems, was based on water-quality and ancillary data from 35 of the wells sampled and water-quality data from the California Department of Public Health (CDPH) database. The primary aquifers are defined as those parts of the aquifers corresponding to the perforated intervals of wells listed in the CDPH database.

Inorganic constituents with human-health benchmarks were detected at high concentrations in 9.1 percent of the primary aquifers, moderate in 36.4 percent, and low in 54.5 percent. Nitrate was the inorganic constituent most frequently detected at high concentrations in 8.8% of the primary aquifers.

In contrast, organic constituents (one or more) with human-health benchmarks were detected at high concentrations in 18.2% of the primary aquifers, moderate in 42.9%, and low in 38.9%. The high aquifer-scale proportion of organic constituents primarily reflected high aquifer-scale proportions of trichloroethene (TCE; 14.8%), tetrachloroethene (PCE; 11.2%), and carbon tetrachloride (6.5%).

In the San Fernando-San Gabriel groundwater basins, solvents were detected at high concentrations in 18 percent of the primary aquifers, while in most California Priority Basin Project study units, solvents were detected at high concentrations in less than 2% of the primary aquifers. Overall, solvents were detected in 86 percent of the grid wells sampled. The number of solvents detected in each well ranged from 1 to 11, and the solvent concentrations ranged from 0.01 to 220 μg/L. The median human-health regulatory benchmark for the 15 solvents detected is 6 μg/L.

High concentrations of solvents are generally clustered in the southern San Gabriel Valley and the central southern San Fernando Valley. Sources of solvents include metal plating, machinery degreasing, and dry cleaning, and more than a dozen solvent plumes have been documented.