

US EPA ARCHIVE DOCUMENT

Developing and Utilizing Isotopic and Tracer Tools to Evaluate the Source and Movement of Nitrate in Contaminated Ground Water in the Lower Umatilla Basin, Oregon

Project Type

This is an EPA Region 10 Regional Applied Research Effort project established between EPA's Ground Water and Ecosystem Restoration Division (Elise Striz, Project Officer) and EPA Region 10 (Curt Black, Project Officer). The research was conducted under Interagency Agreement DW14994101 with the Washington State U.S. Geological Survey (Anthony Paulson, Principal Investigator) and the Oregon Department of Environmental Quality (Phil Richerson, contact).

Project Period

August 1, 2003 through June 30, 2006

Project Summary

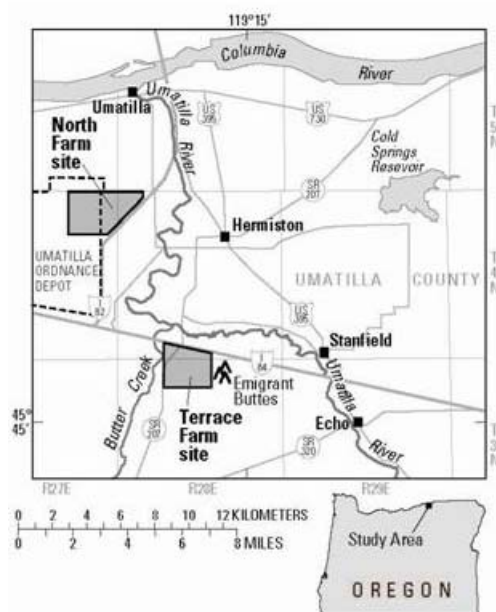
The Lower Umatilla Basin Ground Water Management Area is a 550-square-mile area that stretches from Pendleton, Oregon, to the Columbia River. The area features a complex ground water flow system characterized by nitrate concentrations that often exceed the drinking water standard (by greater than 7 milligrams per liter nitrate). Five major sources of ground water nitrate in the basin have been identified, including irrigated agriculture, food processing waste land application, concentrated animal feedings operations, an army base ordinance depot, and septic systems.

The objectives of this research are to answer two questions:

- What is the source of the nitrate in specific wells?
- How long has the nitrate been migrating from the source?

To answer these questions, EPA scientists will develop isotopic tools to identify which of the five sources of nitrate are present in a particular well and time-of-travel techniques to determine how long the nitrate has been traveling from the source.

Water samples from wells were collected beneath and downgradient from two food-processing wastewater-application sites near Umatilla, Oregon. These samples were analyzed for nitrate stable isotopes, nutrients, major ions, and age-dating constituents. End-member mixing analysis was used to determine the relative amounts of each identified end member within the samples collected from the Terrace Farm site. The delta nitrogen-15 ($\delta^{15}\text{N}$) of nitrate generally ranged between +2 and +9 parts per thousand and the delta oxygen-18 ($\delta^{18}\text{O}$) of nitrate generally



ranged between -2 and -7 parts per thousand. None of the samples that were determined to be associated with the wastewater were different from the samples that were not affected by the wastewater. The nitrate isotope values measured in this study are also characteristic of ammonium fertilizer, animal and human waste, and soil nitrate; therefore, it was not possible to differentiate between food-processing wastewater and the other nitrate sources. Values of $\delta^{15}\text{N}$ and $\delta^{18}\text{O}$ of nitrate provided no more information about the sources of nitrate in the Umatilla River basin than did a hydrologic and geochemical understanding of the ground water system derived from interpreting water-level and major-ion chemistry data.

Products

Frans, L., A. Paulson, P. Richerson, E. Striz, and C. Black. (2009). "Evaluation of Sources of Nitrate Beneath Food processing Wastewater-Application Sites Near Umatilla, Oregon." U.S. Geological Survey Scientific Investigations Report 2009-5069, 14 p.

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