Tracking Groundwater With Isotopes
In this issue, we look at the use of isotopes to determine groundwater ages and flow paths. The original title for this issue was “Tracking Ancient Waters,” but as we started gathering the feature articles, we realized that much of the water being tracked was actually relatively young. The nuclear bomb testing of the 1950s and 1960s was destructive in so many ways, however it did produce many isotopes useful in hydrology today. Alternatively, ancient waters are also being identified by isotopes in several Southwest basins.

As these articles demonstrate, the information we can gain from isotopes is impressive, as is the magnitude of what we’re working with. One tritium unit is equal to one atom of tritium in every 1018 atoms of “regular” hydrogen, a difficult concept to grasp. The distance from Earth to the moon is on the order of 1010 inches, to the sun is 1012 inches, and our orbit around the sun is some 1013 inches. As little as 0.6 tritium unit, the current detection limit, can tell us something about the last time groundwater was in contact with the atmosphere, or when it was recharged.

We are grateful to our features authors for their hard work on these articles.

As the expression goes, all good things must come to an end. Beginning with the May/June 2003 issue, subscriptions to Southwest Hydrology will cost $35 per year (6 issues). Individual and extra copies will cost $10 each. We are pleased by the steady growth of our advertising support. We have shown that this is a valuable endeavor, and now we need to develop it into a viable product. Don’t wait until the last minute and risk missing an issue – send us your check using the envelope inserted in this issue.

Our thanks to all the contributor listed on opposite page, and as always, we welcome your comments and ideas.

Betsy Woodhouse
Editor

Cover: Mushroom cloud from Ivy Mike, the first true hydrogen bomb tested. The Nov. 1, 1952 explosion obliterated the island of Elugelab in the South Pacific and produced huge atmospheric releases of radioactive isotopes, many of which are used extensively as environmental tracers. Image originally from Los Alamos National Laboratory, obtained through the High Energy Weapons Archive at nuketesting.enviroweb.org/hew/Usa/Tests/Ivy.html.
Tracking Groundwater with Isotopes

Isotopes can be powerful tools in the field of hydrology, able to provide definitive answers to questions of recharge and flowpaths that many thousands of dollars’ worth of aquifer tests, new boreholes, and models may not. But what are isotopes, really, and how does one begin to figure out which ones could be applied in a particular setting? Several experts in the field discuss interpretation, analyses, and costs, and present case studies to illustrate how they have been applied successfully in Southwest basins. And, if you want to learn more, we provide the references to take you further.

Dating Groundwater with Isotopes
Brenda Ekwurzel, Ph.D.

An introduction to the isotopes that are used to determine residence time, sources for age-dating isotopes, and guides for assessing which isotopes are appropriate with regard to their age-range, sample volume size, and analytical measurement.

Isotopic Tracers in Groundwater Hydrology
Richard W. Hurst, Ph.D.

What isotopes are commonly used for which applications? How and where are they analyzed? What are typical costs? Isotopes are powerful tools, but they must be carefully applied.

Locating Recharge Zones with Isotopes
C.J. Eastoe, Ph.D.

Does recharge to the regional aquifer occur uniformly along the washes? The relative rates of water movement between flood-plain sediment and the regional aquifer have been determined semi-quantitatively using radioactive isotopes with appropriate half-lives.

Use of Isotopes to Estimate Groundwater Age and Flow Path

The distinct oxygen isotopic character of Colorado River water allowed it to be used as a tracer to determine groundwater flowpaths. Tritium/helium isotopes provided groundwater ages and recharge rates.

Isotope Investigations in the Middle Rio Grande Basin
Compiled from U.S. Geological Survey references

Isotope analyses allowed significant regional patterns of groundwater age and character to be mapped throughout the Middle Rio Grande Basin. These patterns appear to reflect recharge from the basin margins and from the Rio Grande.

Isotope Hydrology
Web and Print Resources
James F. Hogan

An annotated listing of helpful Web sites and textbooks to learn more about isotopes and their applications in hydrology.