Annual Report of project DEFG07-96-ER14732 entitled “Nuclear Magnetic Resonance Imaging of Subsurface Water Content”

Jan M.H. Hendrickx, PI at New Mexico Tech. (Phone: 505-835-5892; e-mail: hendrick@nmt.edu).

During the period from October 1997 to January 1998 we have further developed our understanding of NMR physics, improved software for forward and inverse modeling of the NMR signal, and conducted field tests on sites in Colorado and New Mexico.

One important result from the forward modeling was that the field strength of the signals is concentrated under the loop. This indicates that little lateral dissipation occurs.

We received the NUMIS/NMR system (manufactured by IRIS Instruments, France) in late July, 1997. In July and early August, 1997, potential test sites were visited, and several test sites were selected and permitted. The first NMR test measurements were made in mid-August, 1997. The instrument malfunctioned during mid-September, 1997, and was returned to IRIS for repairs. Time lost due to malfunction, repairs, and shipping was about one month.

Many NMR measurements have been made at sites in Colorado and New Mexico. Parks often have been selected as test sites due to ease of permitting, the relatively large open space, and general lack of powerlines. Noise from power lines severely degrades the NMR data quality. The NMR data acquired at the first three sites in Colorado (Bear Creek, Clear Creek, and Prospect) was either severely distorted by powerline noise or did not indicate significant groundwater occurrences. The NMR data taken at Cherry Creek were of good quality and also indicated significant groundwater.

The NMR data acquired at three sites with relatively shallow ground water levels around Socorro, New Mexico, did not detect any ground water due to severe signal distortion by magnetite, a magnetic mineral. Measurements in a compact sand stone near Santa Rosa and in a limestone near Artesia, New Mexico, gave excellent results.

Overall, the NMR technique proves capable of detecting subsurface ground water under the right conditions: little noise from power lines and absence of magnetite.