USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: FIELD VERIFICATION OF THE DIPOLE FLOW TEST: A NEWAPPROACH FOR THE IN-SITU DETERMINATION OF TRANSPORT PARAMETERS

Duration: April 1, 1997 -August 31, 1998

Federal Funds: $40,147

Non-Federal Funds pledged: $90,239

Name and University of Principal Investigator:

Vitaly A. Zlotnik, Department of Geology, University of Nebraska-Lincoln

Congressional District of University: **1**

Statement of Critical Regional or State Water Problem:

Many of the important aquifers in Nebraska and Kansas consist of unconsolidated alluvium lying in major river valleys. Protection of the water quality of these aquifers is a matter of the highest concern. Within both states, there are numerous cases of landfills, waste sites of various types, and irrigated lands overlying these alluvial aquifers. There is a critical need to evaluate the threat that such sites pose to the water supplies of neighboring communities

A key element of efforts to evaluate this threat is the prediction of how a contaminant might move in the subsurface. For this purpose, annually tens of thousands of new wells for aquifer testing and characterization are installed in the U.S. However, current methodology is often incapable of providing information of the detail and reliability required for evaluation efforts. A major source of this inadequacy is that the majority of methods currently used for the characterization of subsurface properties assume that alluvial aquifers are homogeneous. In actuality, these deposits tend to be a complex intermingling of lenses of gravel- through clay-sized materials. This heterogeneity drastically reduces efficiency of characterizing aquifer properties, as major pathways in the subsurface along which contaminants may move preferentially can be completely missed. In addition, most of available methods of aquifer testing at the sites of subsurface contamination require treatment of polluted water after its withdrawal. There is a pressing need to employ techniques that will allow the actual complexity of the geologic system to be assessed. The field evaluation of one very promising approach, the dipole flow test, is the purpose of the work of this proposal. The new method and dipole probe developed in the University of Nebraska-Lincoln (UNL) need to be assessed at the well characterized sites in Nebraska and Kansas to develop recommendations for further transfer of this methodology.

Statement of Results or Benefits:

The primary results of this research will be the following: 1) a thorough field assessment of the dipole flow test at two thoroughly studied sites in Nebraska and Kansas; 2) a detailed comparison of this new methodology with currently available approaches for aquifer characterization (the multi-level slug test and the borehole flowmeter test); 3) the development of practical guidelines for the performance and interpretation of dipole flow tests. The dipole flow test has considerable potential to become a standard tool for subsurface characterization at sites of suspected groundwater contamination because of the ease of use and the fact that no water is actually removed from a well during testing. The technique can be performed quite rapidly, as only a few minutes are needed to establish steady state at any given position in the well. Note that the recirculatory flow cell in the vicinity of the dipole tool is very similar to the recirculatory flow systems that are used in many promising remediation technologies. Thus, this research will also provide considerable insight into flow regimes that are of significance to many remediation methods.

One full-time Ph.D. student at the UNL will be supported by the project. In addition, summer support will be provided for a M.S. student at the University of Kansas (KU). It is expected that the results of this research (including installed wells) will be incorporated into courses in hydrogeology that are offered at UNL and KU. Note that both V. Zlotnik and 1. Butler currently teach a field methods in hydrogeology course at UNL and KU, respectively.