

SUPPORT FOR CONSULTANT REQUEST

CONSULTANT: Dr. Walter Illman

RATE:

PERIOD OF PERFORMANCE: August 25, 2001 through August 25, 2002

STATEMENT OF WORK: Dr. Walter Illman is a recent employee of the GHGC element of the CNWRA. He was involved in several projects before his departure to the University of Iowa to become an Assistant Professor in Geoscience and Civil and Environmental Engineering.

He has been working with Dr. Debra Hughson on numerical modeling unsaturated flow in thick vadose zones. This work was undertaken as an activity under the Unsaturated and Saturated Flow Under Isothermal Conditions (USFIC) Key Technical Issue (KTI). This modeling effort is being used to evaluate the characterization and modeling of unsaturated zone (UZ) flow by the U.S. Department of Energy that may be used to support a potential license application for a high-level nuclear waste repository at Yucca Mountain. The numerical modeling by Dr. Illman is focused on evaluation of uncertainty in the spatial and temporal distribution of unsaturated flow due to heterogeneity of rock properties. The preliminary results of modeling to date reveal the potential for development of preferential pathways in the UZ. Because Dr. Illman has been the lead investigator in this modeling effort, his assistance will be needed to complete and document the ongoing work. In addition to completing this work for the USFIC KTI, Dr. Illman has also been requested to perform follow-on modeling to evaluate the potential effects of heterogeneity and infiltration boundary conditions that might affect the results of thermal-hydrologic modeling. This follow-on modeling investigation would be conducted in support of the Thermal Effects on Flow (TEF) KTI. Dr. Illman's assistance has been requested for the following tasks:

TASK 1 – USFIC: Dr. Illman will complete his modeling investigation of steady-state flow in a two-dimensional, heterogenous, layered, unsaturated fractured-rock system. Modeling will be performed using the METRA code. Ten realizations of heterogenous fracture permeability have already been generated to examine the potential for preferential flow and flow focusing. This task will support the USFIC KTI under the supervision of James Winterle. Debra Hughson will assist in the interpretation and documentation of modeling results. Documentation will be provided in an electronic format that is compatible with Word Perfect Version 8 and will include a description of methods and assumptions, modeling results, discussion of results, conclusions, references, and any figures and tables necessary to convey this information. This documentation may be formatted in a manner suitable for submission to a refereed journal. **The estimated level of effort for this task is approximately 250 hours.** The task is to be completed and documentation delivered to CNWRA by December 31, 2001.

TASK 2 – TEF: Dr. Illman will summarize in a deliverable the geostatistical analysis of hydraulic, pneumatic, and thermal properties of unsaturated fractured tuffs at the Apache Leap Research Site. Statistical parameters obtained from this effort may be useful for stochastic simulations of UZ flow and transport under both isothermal and non-isothermal conditions. This work will be undertaken as an activity under the Thermal Effect on Flow Key Technical Issue and will be supervised by Dr. Debra Hughson. **The estimated level of effort for this work is 200 hours.** The task is to be completed and documentation delivered to CNWRA by December 31, 2001.

ESTIMATED UTILIZATION (hours):

An estimated 450 hours of Dr. Illman's time will be needed to support the USFIC and TEF KTI during the FY 2001 and 2002.

PRIOR CONTRACTOR WORK EXPERIENCE WITH SwRI:

Dr. Illman is a former employee of the CNWRA, Division 20 of SwRI.

PROGRAMMATIC NEED FOR CONTRACTOR WORK:

The CNWRA Operations Plan for the Repository Program for FY2002 under Contract NRC-02-97-009 describes the continued development of models to investigate deep percolation in the UZ.

LIST OF ELIGIBLE CONSULTANTS CONSIDERED:

Because of his familiarity with this continuing work, Dr. Illman is the sole source of expertise considered for his activity.

RATIONALE FOR SOLE/SINGLE SOURCE SELECTION:

The portion of work supported by the USFIC KTI involves completion and documentation of Dr. Illman's work performed as a CNWRA employee.

RATIONALE FOR NOT USING SWRI RESOURCES:

As a CNWRA employee, Dr. Illman was the lead investigator on the USFIC-supported modeling of unsaturated flow in heterogenous, layered fractured rocks. Timely completion and documentation of this work can be accomplished most efficiently by having Dr. Illman complete this modeling investigation.

PROJECT NUMBER:

20-1402-861

20-1402-661