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July 7, 1988

009/1.5/WWL.011
RS-NMS-85-009
Communication No. 269

U.S. Nuclear Regulatory Commission
Division of High-Level Waste Management
Technical Review Branch
OWFN - 4H3
Washington, DC 20555

Attention: **Mr. Jeff Pohle, Project Officer**
Technical Assistance in Hydrogeology - Project B (RS-NMS-85-009)

Re: **Subtask 1.5 - Task Description Summary for WWL Technical Report No. 11 "General Relationship Between Recharge and Age Stratification in Saturated Zone at a Well"**

Dear Mr. Pohle:

Attached please find a Task Description Summary (TDS) for a Subtask 1.5 investigation to be entitled "General Relationship Between Recharge and Age Stratification in Saturated Zone Water at a Well." The TDS has been reviewed for technical and managerial content by M. Logsdon (NWC), and the Quality Assurance Task Plan has been reviewed and Approved (as noted, p. 3) by the Project Manager and the Project Quality Assurance Director. The plan was prepared and reviewed at WWL under their quality assurance program, as controlled by the NWC Quality Assurance Manual.

The proposed work addresses approaches that could be used to assess the meaning and significance of the apparent-Carbon-14-age stratification that has been observed in saturated zone wells at Yucca Mountain. It is considered that this Subtask 1.5 study may provide tools that could be very important in evaluating DOE's site characterization plans for the site saturated zone and regional hydrologic investigations. In developing the technical report, WWL and NWC will take full cognizance of the USGS comments concerning the CDSCP on the use (and misuse) of C-14 in hydrologic studies.

D1021
WM-11 NH14

If you have questions about this letter or about WWL's Task Description Summary, please contact me.

Respectfully submitted,
NUCLEAR WASTE CONSULTANTS, INC.

Mark J. Logsdon, Project Manager

cc: US NRC - Director, NMSS (ATTN PSB)
HLWM (ATTN Division Director)
Edna Knox, Contract Administrator
HLTR (ATTN Branch Chief)
D. Chery, HLTR

L. Davis, WWL
M. Galloway, TTI
J. Minier, DBS

WATER, WASTE & LAND, INC.
NEVADA NUCLEAR WASTE STORAGE INVESTIGATIONS
TASK DESCRIPTION SUMMARY #5

1.0 TASK TITLE: General Relationships Between Recharge and Age Stratification in Saturated Zone Water at a Well

2.0 OBJECTIVES:

Several wells near Yucca Mountain have shown an increase in apparent ground water age with depth in the saturated zone. The objective of this report is to demonstrate the general relationships between hydrologic parameters of the saturated zone, the distance a well is from a recharge area, and the resulting stratification of the waters. The report will provide general methods which can be used to identify key parameters effecting those relationships.

3.0 TECHNICAL APPROACH:

It can be assumed that the recharge waters entering the saturated zone's regional flow are younger in apparent age than the water of the regional flow. As this recharge water moves downgradient in the saturated zone, various processes will cause the older regional ground water to mix with the newer recharge water.

In a well close to the recharge area, the younger water should be found at the top of the saturated zone, with older waters being found deeper in the wellbore. As the distance from the recharge area increases, the effects of mixing and diffusion will decrease the age stratification across the saturated zone.

Using a simplified flow system, the parameters which affect this age stratification can be determined. A sensitivity analysis will show the parameters having the greatest impact on disrupting the age stratification of the waters. This problem relates directly to the flow system occurring around and at Yucca Mountain. As an example, the following is a direct quote from the Consultation Draft Site Characterization Plan, Volume II, page 3-111:

> Carbon-14 data from well USW H-6 (Benson and McKinley, 1985) show an increase in apparent ground-water age with depth in tuffaceous rocks. The interval 526 to 1220 m (the entire saturated thickness penetrated) yielded water with an age of 14,600 yr; the interval 608 to 646 m yielded water 16,800 years old; and the interval 753 to 853 m yielded water 18,500 yr old. A flow-meter survey (Benson et al., 1983) shows significant water yield between the water table (526 m) and a depth of 790 m. Because water pumped from the entire saturated zone (526 to 1,220 m) included older water from the two deeper zones, it is probable that water in the uppermost part of the saturated zone is considerably younger than 14,600 yr.

The proposed model to be used in this study is an analytic solution to the three-dimensional advection-dispersion equation.

4.0 PRODUCT DESCRIPTION:

The product which will be delivered will consist of a Technical Report which will summarize the results of the analytical and numerical analyses. The report will include discussion of pertinent theory and detailed descriptions of models utilized including listings of computer programs used in the study.

5.0 TASK ASSIGNMENTS:

Thomas Sniff has been assigned primary responsibility for this task. He will be in charge setting up the computer program necessary to obtain the analytical solution, performing the modeling studies, and writing the draft report. Managerial and Quality Assurance activities will be coordinated by Lyle Davis, NNWSI Project Manager. Prior to issuance, the draft report will be reviewed by Dr. David McWhorter, NNWSI Project Director. Both Mr. Davis and Dr. McWhorter will be available for technical assistance to Mr. Sniff during the code development and modeling aspects of the study.

6.0 MANPOWER ASSIGNMENTS:

The following summarizes our estimates of manpower resources required to complete the proposed task:

Title	Name	Hours
Project Director	David B. McWhorter	16
Project Manager	Lyle Davis	32
Sr. Engineer	Thomas Sniff	152
Clerical	Donna Loomis	16
Draftsman	Bruce Jordan	24

7.0 SCHEDULE:

Based on anticipated workload, the work associated with this task should not be initiated prior to July 19, 1988. The draft report will be submitted within two months of notification to proceed.

8.0 QUALITY ASSURANCE TASK PLAN:

This section of the Task Description Summary (TDS) is dedicated to a description of Quality Assurance (QA) activities envisioned during performance of this task. It is essentially a modification of the QA Task Plan format specified previously by NWC and includes only those items which are not specifically covered in the previous sections. This plan has been designated as QA Task Plan Number 9.

8.1 QA APPLICABILITY

This task has been assigned a QA level of 1A. This QA level was assigned based on the assumption that the technical reports issued under subtask 1.5 may be used as the bases for various decisions regarding site characterization. QA records for this task will include:

1. Task Description Summary (including QA Task Plan)
2. Listings and descriptions (hard copy) of any programs developed or used for the task. JG 6-22-88 mjl 6/24/88
3. Initial Draft Report
4. Check-list of QA activity
5. Draft Final Report
6. NWC/NRC Comments Regarding Draft Final Report
7. Final Report
8. Completed Record of Report/Analysis Review Form

8.2 DATA AND DOCUMENTATION HANDLING PROCEDURES

Data to be utilized will primarily come from reports in the WWL Document Data Base. Some of this data is presently resident in the WWL Data Base in Lotus 1-2-3 files. All data utilized will be referenced to the appropriate report.

8.3 DATA REDUCTION, VALIDATION, AND REPORTING PROCEDURES

Data which will be used in this study currently exists in the data base which is maintained as part of this project. Since the modeling is intended to evaluate only order-of-magnitude effects, the input data utilized will be based on currently available data. Therefore, data reduction will not be required and available data will be assumed valid for the purposes of this study. The sources of all data will be documented in the report.

8.4 PERFORMANCE AUDITS

A performance audit will be performed when the first draft of the technical report is completed.

8.5 ASSESSMENT PROCEDURES FOR DATA/REPORT ACCEPTABILITY

The draft technical report will undergo management review for adequacy of the topic coverage and overall responsiveness to contractual requirements.

8.6 CORRECTIVE ACTION

Should corrective action be indicated by any of the QA procedures and reviews, personnel responsible for a given task will be responsible for determining the nature of the corrective action, subject to both management and QA review. All corrective action will be documented.

8.7 QA REPORTS TO MANAGEMENT

The QA file will be available for management review at the end of the performance audit and at the completion of the task. A task plan will be provided. In addition, QA activities related to this task will be listed in monthly and annual summary QA reports.

8.8 TASK PLAN REVIEW AND APPROVAL

Level 1 and 1-A task plans shall be reviewed and approved prior to issuance by: Task Manager, Subcontractor Management, NWC QA Director, and NWC Project Manager. Approval signatures and dates appear on the following page.

QUALITY ASSURANCE TASK PLAN NUMBER 9

SUBTASK 1.5 UPDATE

TECHNICAL REPORT NUMBER 11

GENERAL RELATIONSHIPS BETWEEN RECHARGE AND AGE STRATIFICATION

IN SATURATED ZONE WATER AT A WELL

WATER, WASTE AND LAND, INC.

JUNE, 1988

APPROVED:
(TASK MANAGER)
Tom Siff

DATE: 6-7-88

APPROVED:
(SUBCONTRACTOR MANAGEMENT)
Lyle A Davis

DATE: 6-7-88

APPROVED:
(NWC QA DIRECTOR)
Thomas M Stetz

DATE: 6/22/88 as noted p. 3

APPROVED:
(NWC PROJECT MANAGER) Mark Tognolini

DATE: 6/25/88 as noted p. 3