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August 5, 1986

009/1.2/WWL.002
RS-NMS-85-009
Communication No. 82

U.S. Nuclear Regulatory Commission
Division of Waste Management
Geotechnical Branch
MS-623-SS
Washington, DC 20555

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

Re: **Semi-Annual Update of NNWSI Data Inventory and Management System - Subtask 1.2, Report No. 2**

Dear Mr. Pohle:

This cover letter transmits to the NRC staff the first semi-annual update of the Data Inventory and Management System Report for NNWSI, Subtask 1.2 of Contract No. RS-NMS-85-009. This report has been prepared by the Mssrs. Lyle Davis and Tom Sniff members of the Water, Waste and Land (WWL) site team for NNWSI. The report has received management and technical reviews by Mark Logsdon of Nuclear Waste Consultants.

Attachment A of the WWL report is the updated version of their bibliographic data base, which now lists 228 NNWSI-related documents. Attachment B is the updated set of short-form document reviews - now numbering 70 NNWSI documents - that complements the document listing and supplements the formal document reviews that have been submitted to the NRC Project Officer. Attachment C is a print-out of a LOTUS 123 data file, called NRCDATA, compiled by WWL to allow easy access to and statistical manipulation of specific hydrogeologic data for NNWSI. Attachment 4 is a set of updated copies of seven well summary charts.

WM-RES
WM Record File D1021 NWCI

WM Project 10, 11, 16
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Distribution:
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WWL/NWC anticipates that these products will evolve with the project. Updates of the data inventory and management system for NNWSI will be submitted to the NRC in the semi-annual documents that are stipulated in the current contract.

The submission of this letter report meets the contractual deliverable for Subtask 1.2 of Contract Number RS-NMS-85-009 and completes the subtask requirements for Data Inventory and Management for NNWSI at this time. Per the terms of the contract, WWL/NWC will submit regular updates of this report.

If you have any questions concerning this report or related matters, please contact me immediately.

Respectfully submitted,
NUCLEAR WASTE CONSULTANTS, INC.

Mark J. Logsdon

Mark J. Logsdon, Project Manager

Att: NNWSI Data Inventory/Management Update Report

cc: US NRC - Director, NMSS (ATTN: PSB)
DWM (ATTN: Division Director) - 2
Mary Little, Contract Administrator
WMGT (ATTN: Branch Chief)

M. Galloway, TTI
J. Minier, DBS

bc: L. Davis, WWL

See D1021 8/5/86
J. Pohle
Communication No. 82

Water, Waste & Land, Inc.
CONSULTING ENGINEERS & SCIENTISTS

AUG 0 1 1986

July 31, 1986

WWL #4001

Nuclear Waste Consultants, Inc.
8341 So. Sangre de Cristo Road
Suite 6
Littleton, Co 80127

Attention: Mr. Adrian Brown, Project Director

Re: Data Management Report, Subtask 1.2

Dear Mr. Brown:

This letter serves as our semi-annual update of the report for Subtask 1.2, Data Inventory and Management, as required by our subcontract with Nuclear Waste Consultants. After your review of this report, please forward it to Jeff Pohle at the US Nuclear Regulatory Commission.

BACKGROUND

Nuclear Waste Consultants (NWC) is a prime contractor for NRC Project RS-MNS-85-009 entitled "Technical Assistance in Hydrology - Project B - Analysis." Water, Waste and Land, Inc. (WWL) is a subcontractor to NWC and is responsible for review of hydrogeologic investigations of the Nevada Nuclear Waste Storage Investigations Project (NNWSI). Part of the contract requires submission of a letter report updating the Data Inventory and Compiled Database six months after submitting the first report.

1311 South College Avenue, Fort Collins, Colorado 80524 (303) 482-1147

DATA BASE DESCRIPTION

The overall database has been divided into two components:

1) Data Inventory

2) Summarized Data

The data inventory summarizes the draft or final reports and published papers which have been made available to WWL. A computerized data base is utilized for the management of the library of available information. The database contains pertinent bibliographic information (title, author, date, document number). This information is shown in Attachment A. As each document is reviewed, additional information is added to the database (key words, key data, general comments, and summary). This information, for documents reviewed to date, is shown in Attachment B.

Two formats have been chosen for the presentation of the summarized data. The first is by well charts, which enables the data to be presented as a function of depth. In this format, well construction, intervals cored, drilling data, lithologic logs, hydrologic logs, permeability, porosity, saturation, etc., can be presented for each drill hole as a function of depth. The spatial coordinates and ground surface elevation at the well makes three-dimensional relationships between structure and physical characteristics possible. The currently initiated well logs are shown in Attachment D.

The second format for the presentation of summarized data is by computer data base. The data base contains information obtained from the test wells at and around Yucca Mountain. Information contained in the computer data base has been obtained by either core analysis or from well tests. Information includes porosity, permeability, storage coefficient, depth of core, well test interval, and the document and page number from which the data was obtained. The

information is contained in a LOTUS 123 data file, called NRCDATA, which allows for easy transfer and manipulation. This format enables the large statistical capabilities of LOTUS 123 to be utilized for data analysis.

DATA BASE STATUS

Data Inventory

The bibliographic information for 228 documents have currently been entered into the computerized database (Attachment A). Informal summaries of 70 documents are presented in Attachment B. Summaries will continue to be added to the data base on a priority based upon information provided by the project officer and other project requirements (e.g., numerical analyses).

Summarized Data

Summary well charts have been initiated for seven wells. The following wells have had well charts prepared: USW G-1, USW G-3/GU-3, USW G-4, USW H-3, USW H-4, USW H-5, and UE25a-6. Well USW H-1 and the UZ wells are the next priority for well sheet preparation. The UZ wells are relatively new and little information has been published about them.

The LOTUS 123 data base contains physical data from six wells: USW G-4, USW H-1, USW H-3, J-13, UE-25b#1, and UE-25a#1. The data entered thus far represents eleven hydrogeologic units. The units and their abbreviations used in the data base are:

TCw.....Tiva Canyon welded

PTn.....Paintbrush Tuff nonwelded

TSw.....Topopah Spring welded

CHnv.....Calico Hills nonwelded vitric

CHnz.....Calico Hills nonwelded zeolitic

PPw.....Prow Pass welded

CFn.....Crater Flat

BFw.....Bull Frog welded

Tram.....Tram

Older.....Older Tuff

LR.....Lithic Ridge

A plus (+) after an abbreviation indicates that a well test included one or more underlying units. A complete printout of the NRCDATA data base file is presented in Attachment C.

SUMMARY

The data management techniques which have been developed and implemented will allow the WWL team to continue to efficiently review data relative to the NNWSI Project. As new data becomes available during site characterization, the data bases can quickly be updated and utilized for analysis purposes.

If you have questions or if we can in any way be of assistance to you during your review of this report, do not hesitate to contact us.

Sincerely,

WATER, WASTE AND LAND, INC.

Lyle A. Davis

Lyle A. Davis, P.E.
Project Manager

LAD:dml

Attachments as noted

ATTACHMENT A

NEVADA NUCLEAR WASTE STORAGE INVESTIGATION
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ATTACHMENT B

NEVADA NUCLEAR WASTE STORAGE INVESTIGATION
HYDROGEOLOGY DOCUMENT SUMMARY SHEETS
WATER, WASTE & LAND, INC.
DATA BASE

July 30, 1986

NRC DOCUMENT DATA BASE

WWL Document Number: 1 Document Summary

TITLE: Hydrologic Mechanisms Governing Fluid Flow in Partially Saturated, Fractured, Porous Tuff at Yucca Mountain

AUTHOR: Wang, J.S.Y. and Narasimhan T.N.

Document Number: LBL-18473 Publication Date: Oct. 1984
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Document Rating (1=poor to 10=excellent): 8
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS,LAD,DBM

KEY WORDS: Fracture Flow, Unsaturated Flow, Conceptual Model, Numerical Model

KEY DATA: Fracture Inclination

COMMENTS: The paper has received a formal review.

SUMMARY:
A general statistical theory is proposed to describe flow along and across fractures that separate partially saturated matrix blocks. This theory incorporates a model for estimating fracture aperture distributions and yields expressions for fracture saturation, fracture permeability, and effective areas of matrix-fracture flow as functions of pressure. With these expressions, drainage of a fractured tuff column was simulated using the TRUST numerical model. The values for parameters in the expressions are deduced from observations of fracture spacings and orientations in samples from Yucca Mountain, measurements of pressure-saturation relationships of matrix core samples and indirectly derived fracture-surface characteristics. In the simulations of the draining column, discrete vertical and horizontal fractures and intervening matrix blocks were explicitly taken into account.

NRC DOCUMENT DATA BASE

WWL Document Number: 2 Document Summary

TITLE: Preliminary Bounds on the Expected Postclosure Performance of the Yucca Mountain Repository Site, Southern Nevada

AUTHOR: Sinnock, Scott, Lin, Y.T. and Brannen Joseph P.

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Document Rating (1=poor to 10=excellent): 8
Document Description (general, specific, etc.): Overview
Document Read By (Initials): TLS

KEY WORDS: Conceptual Model, Flux, Unsaturated Flow, Saturated Flow, Flow Time, Solubility, Retardation, Waste Dissolution Rate, Radionuclide Release

KEY DATA: Matrix Properties, Fracture Properties, Solubilities, Radionuclide Inventory, Water Composition, Sorption Values

COMMENTS: The report gives a first order approximation to the performance characteristics of the repository.

SUMMARY:
A conceptual model is developed for the flow through the unsaturated zone. Low flux results in groundwater travel times to the water table that probably exceed 10000 years and may exceed 100000 years. The low flux will also limit releases of waste from the waste packages; the corresponding releases of curies would be well within the allowable releases set by the NRC. Geochemical retardation by sorption and diffusion will slow radionuclide movement relative to groundwater flow by factors of hundreds to thousands for many waste species. In combination, these site conditions provide a high degree of confidence that no releases to the accessible environment will occur during the first 10,000 years after repository closure. Even if rapid fracture flow were to occur, release of wastes to the accessible environment would probably remain low with respect to the EPA's limits.

NRC DOCUMENT DATA BASE

WWL Document Number: 3 Document Summary

TITLE: Conceptual Hydrologic Model of Flow in the Unsaturated Zone, Yucca Mountain, Nevada

AUTHOR: Montazer, P., and Wilson, W. E.

Document Number: USGS-84-4345 Publication Date: 1984
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 9
Document Description (general, specific, etc.): general
Document Read By (Initials): TLS,LAD,DBM

KEY WORDS: Hydrologic Model, Fracture Flow, Unsaturated Flow, Capillary Barrier, Hysteresis, Vapor Transport, Ground Water Flow, Perched Water

KEY DATA: Hydrologic properties

COMMENTS: The conceptual flow model presented is based on many assumptions which the data may or may not support. Generally a good paper to read.

SUMMARY:
A conceptual model describing the flow of fluids through the unsaturated zone at Yucca Mountain is proposed. The proposed model considers the following flow phenomena in the unsaturated region: flow through fractured rock, capillary barriers, infiltration into fractured rock, lateral movement, and capillary fringe. The proposed model gives a representation of the flow in the hydrogeologic units and structural pathways at Yucca Mountain. Areas needing further investigation are identified.

NRC DOCUMENT DATA BASE

WWL Document Number: 4 Document Summary

TITLE: Commercial Geophysical Well Logs From The USW G-1 Drill Hole, Nevada Test Site, Nevada

AUTHOR: Muller, D. C., Kibler, J. E.

Document Number: USGS-OFR-83-321 Publication Date: 1983
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Caliper Log, Gamma Ray Log, SP Log, Resistivity Log, Neutron Log, Density Log, Velocity Log, Porosity Log

KEY DATA: Summary of drill hole USW G-1 logging operations.

COMMENTS: Referenced plates #1 and #2 are not contained with the report.

SUMMARY:
The logs usefulness as lithologic indicators is limited primarily to correlations with welding in the tuff. The major conclusion that can be drawn is that the physical properties of the tuffs above the Tram Unit are quite variable, while Tram and tuff of Lithic Ridge are more uniform and predictable. Future work should include borehole gravimetry for surface gravity modeling, IP logs to determine sulfide mineral content, magnetometer logs for stratigraphic correlation and for paleomagnetic models, and magnetic susceptibility logs.

NRC DOCUMENT DATA BASE

WWL Document Number: 5 Document Summary

TITLE: Borehole Geophysical Measurements for Hole UE25a-3, Nevada Test Site, Nuclear Waste Isolation Program

AUTHOR: Daniels, J. J., and Scott, J. H.

Document Number: USGS-OFR-80-126
Publication Date: 1980
Requested From: NRC
Request Date: Oct. 85
Received From: NRC
Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Density Log, Resistivity Log, Gamma Ray Log, Neutron Log, Induced Polarization Log, Magnetic Susceptibility Log

KEY DATA: None

COMMENTS:

SUMMARY:
Borehole geophysical measurements made in drill hole UE25a#3 with a USGS survey truck are presented. Well logs are presented in this paper for dual-detector density, normal resistivity, gamma ray, neutron-neutron, induced polarization, and magnetic susceptibility measurements. These data are analyzed for correlations with the core lithology. Hole-to-surface measurements made from the drill hole indicate the presence of two resistive bodies at depth. The deeper resistive anomaly may be related to a granitic intrusion.

NRC DOCUMENT DATA BASE

WWL Document Number: 6 Document Summary

TITLE: Finite-Element Simulation of Ground-Water Flow in the Vicinity of Yucca Mountain, Nevada-California

AUTHOR: Czarnecki, J. B., and Waddell, R. K.

Document Number: USGS 84-4349 Publication Date: 1984
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Overview
Document Read By (Initials): TLS

KEY WORDS: Conceptual Model, Parameter Estimation, Mesh Design, Boundary Conditions, Transmissivities, Fluxes, Sensitivity Analysis, Traveltime, Model Residuals, Hydraulic Head

KEY DATA: Transmissivity, Flux, Sensitivity Analysis, Hydraulic Head

COMMENTS:

SUMMARY:
A finite element model was developed using parameter estimation techniques to simulate steady-state ground water flow in the vicinity of Yucca Mountain. Model residuals for simulated versus measured hydraulic heads range from -28.6 to 21.4 meters; most are less than (+,-) 7 meters. The overall agreement between measured and simulated heads is good. Exceptions occur in areas where vertical flow components and/or steep hydraulic gradients occur. The model results also indicate areas where additional studies are needed. The presence of barriers in the model greatly affects the orientation of ground-water flow vectors. Few data are available regarding the shape , orientation, and extent of the barrier north of Yucca Mountain. The traveltime estimation procedure used to determine a possible range in traveltimes provides a means of comparing traveltimes resulting from different values of porosity and thickness. Although changing the anisotropy ratio in western Jackass Flats to achieve greater y-transmissivity versus x-transmissivity did produce faster traveltimes, it also led to larger error variance.

NRC DOCUMENT DATA BASE

WWL Document Number: 7 Document Summary

TITLE: Simulated Effects of Increased Recharge on the Ground-Water Flow System of Yucca Mountain and Vicinity, Nevada-California

AUTHOR: Czarnecki, J. B.

Document Number: USGS 84-4344
Requested From: NRC
Received From: NRC

Publication Date: 1984
Request Date: Oct. 85
Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Overview
Document Read By (Initials): TLS

KEY WORDS: Conceptual Model, Ground Water Flow, Recharge, Finite Element Ground Water Model

KEY DATA: Hydraulic Head Map, Precipitation

COMMENTS:

SUMMARY:
The report assesses the potential effects of changes in future climatic conditions on the ground-water system in the vicinity of Yucca Mountain. The study was performed by simulating the ground water system using a 2-D, finite element ground water flow model. The simulated position of the water table rose as much as 130 meters near the primary repository area at Yucca Mountain for a simulation involving a 100-percent increase in precipitation compared to modern-day conditions. Despite the water table rise, no flooding of the potential repository would occur at its current proposed location. Simulated directions of ground water flow paths near the potential repository area generally would be the same for the baseline (modern day climate) and the increased recharge simulations, but the magnitude of flow would increase by 2 to 4 times that of the baseline simulation flux.

NRC DOCUMENT DATA BASE

WWL Document Number: 8 Document Summary

TITLE: Preliminary Assessment of Climatic Change During Late Wisconsin Time, Southern Great Basin and Vicinity, Arizona, California, and Nevada

AUTHOR: Spaulding, W. G., Robinson, S. W., and Paillet, F. L.

Document Number: USGS 84-4328 Publication Date: 1984
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 8
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Climate, Precipitation, Vegetation

KEY DATA: Paleoclimatic Data

COMMENTS:

SUMMARY:
A period of wetter conditions in the southern Great Basin during the latest Wisconsin may have incorporated increased precipitation during both the summer and winter, and lower temperatures during the winter, relative to the present. Resurgence of closed lakes in the southern Great Basin between 12000 and 10000 radiocarbon years before present and the persistance of exophytic vegetation where desert now exists are explicable phenomena in accordance with a proposed latest Wisconsin pluvial event. The climate of this pluvial event was much different from that of the preceding full glacial episode. Its general nature is consistent with what would be expected from current models of astronomically induced climatic changes.

NRC DOCUMENT DATA BASE

WWL Document Number: 9 Document Summary

TITLE: Two-Dimensional, Steady-State Model of Ground-Water Flow, Nevada Test Site and Vicinity, Nevada-California

AUTHOR: Waddell, R. K.

Document Number: USGS 82-4085 Publication Date: 1982
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Overview
Document Read By (Initials): TLS

KEY WORDS: Conceptual Model, Geology, Ground Water Basin, Numerical Model, Transmissivities, Sensitivity Analyses,

KEY DATA: Hydrologic Units, Transmissivity, Gradient, Flux

COMMENTS:

SUMMARY:
A 2-D, steady-state, finite-element model of the ground water flow system of the Nevada Test Site and vicinity was developed using parameter-estimation techniques. The model simulates flow in an area underlain by clastic, carbonate and volcanic rocks. Sensitivities of fluxes derived from simulated heads and head sensitivities were used to determine the parameters that would most affect predictions of radionuclide transport from a hypothetical nuclear repository in the southwest quadrant of the NTS. The important parameters for determining flux through western Jackass Flats and Yucca Mountain are recharge to and underflow beneath Pahute Mesa; and transmissivities of the Eleana Formation, clastic rocks underlying the Groom Range, tuffs underlying Fortymile Canyon, and tuffs beneath Yucca Mountain. In the eastern part of Jackass Flats, the important parameters are transmissivities of the Eleana Formation and recharge or discharge terms for Pahute Mesa, Ash Meadows, and the Sheep Range.

NRC DOCUMENT DATA BASE

WWL Document Number: 12 Document Summary

TITLE: Ground-Water Level Data and Preliminary Potentiometric-Surface Maps, Yucca Mountain and Vicinity, Nye County, Nevada

AUTHOR: Robison, J. H.

Document Number: USGS 84-4197
Requested From: NRC
Received From: NRC

Publication Date: 1984
Request Date: Oct. 85
Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Ground Water Level, Potentiometric Surface Map

KEY DATA: Well Depths, Well Altitudes, Water Levels

COMMENTS:

SUMMARY:
The report contains data on ground water levels and preliminary maps of the potentiometric surface beneath Yucca Mountain and adjacent areas. The water level surface shown on the maps generally represents unconfined conditions. West of the crest of Yucca Mountain, water level altitudes are about 775 meters above sea level. Along the eastern edge and southern end of Yucca Mountain, the potentiometric surface generally is nearly flat, is about 728 to 730 meters above sea level, and has a southeastward slope.

NRC DOCUMENT DATA BASE

WWL Document Number: 13 Document Summary

TITLE: Geohydrology of Volcanic Tuff Penetrated by Test Well UE-25b#1, Yucca Mountain, Nye County, Nevada

AUTHOR: Lahoud, R. G., Lobmeyer, D. H., and Whitfield, M. S., Jr.

Document Number: USGS 84-4253 Publication Date: 1984
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 6
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Lithology, Fracture Analysis, Geophysical Logs, Hydrologic Monitoring, Hydrochemistry

KEY DATA: Well Construction, Lithologic Log, Porosity, Permeability, Fracture Distribution, Well Tests, Water Chemistry

COMMENTS:

SUMMARY:
Test well UE-25b#1 located on the east side of Yucca Mountain was drilled to a total of 1220 meters and hydraulically tested. The composite hydraulic head for aquifers penetrated by the well was 728.0 meters above sea level, with a slight decrease in hydraulic head with depth. Average hydraulic conductivities for stratigraphic units determined from pumping tests, borehole flow surveys, and packer injection tests ranged from less than 0.001 meter per day for the Tram Member of the Crater Flat Tuff to 1.1 meters per day for the overlying Bullfrog Member of the Crater Flat Tuff. Chemical analysis indicated that the water is a soft sodium bicarbonate type, slightly alkaline, with large concentrations of dissolved silica and sulfate. Uncorrected carbon-14 age dates of the water were 14,100 and 13,400 years.

NRC DOCUMENT DATA BASE

WWL Document Number: 14 Document Summary

TITLE: Geohydrology of Rocks Penetrated by Test Well UE-25p#1, Yucca Mountain Area, Nye County, Nevada

AUTHOR: Craig, R. W., and Robison, J. H.

Document Number: USGS 84-4248
Requested From: NRC
Received From: NRC

Publication Date: 1984
Request Date: Oct. 85
Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 8
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Well Tests, Water Chemistry

KEY DATA: Well Construction, Well Tests, Transmissivity

COMMENTS:

SUMMARY:
Test well UE-25p#1 was drilled to a total depth of 1805 meters. The composite static water level was approximately 381 meters below land surface for the Tertiary section and 361 meters for the Paleozoic section. The likely confining layer is a conglomerate near the bottom of the Tertiary section in the depth interval from 1138 to 1172 meters. In the Tertiary section, an interval of less than 30 meters in the upper part of the Prow Pass Member has an apparent transmissivity of 14 meters squared per day. Composition of water from the Tertiary section was similar to water from other wells in the Yucca Mountain area.

NRC DOCUMENT DATA BASE

WWL Document Number: 15 Document Summary

TITLE: Geohydrology of Test Well USW H-3, Yucca Mountain, Nye County, Nevada

AUTHOR: Thordarson, W., Rush, F. E., and Waddell, S. J.

Document Number: USGS 84-4272 Publication Date: 1985
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Well Data, Well Tests

KEY DATA: Well Construction, Fracture Distribution, Well Tests

COMMENTS: Well test data was not analyzed in this report

SUMMARY:
The report presents data collected to determine the hydraulic characteristics of rocks penetrated in test well USW H-3. Data on drilling operations, lithology, borehole geophysics, hydrologic monitoring, pumping, swabbing, and injection tests for the well are contained in the report.

NRC DOCUMENT DATA BASE

WWL Document Number: 16 Document Summary

TITLE: Preliminary Evaluation of Hydrologic Properties of Cores of Unsaturated Tuff, Test Well USW H-1, Yucca Mountain, Nevada

AUTHOR: Weeks, E. P., and Wilson, W. E.

Document Number: USGS 84-4193 Publication Date: 1984
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 8
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Moisture Tension, Hydraulic Conductivity, Moisture Characteristic Curves, Relative Permeability, Matrix Flux, Mercury Porosimetry Test, Core Volumetric Moisture Content

KEY DATA: Density, Porosity, Volumetric Moisture Content, Moisture Tension, Hydraulic Conductivity, Moisture Characteristic Curves, Saturation-Tension Curves

COMMENTS:

SUMMARY:
Analyses were made on 19 core samples of unsaturated tuff from test well USW H-

1. No direct measurements were made of moisture tension and hydraulic conductivity at ambient moisture content. Moisture char. curves relating saturation and moisture tension were developed from results of mercury injection tests. Ambient moisture tension estimated from these curves generally was 100 to 200 kPa. Values of relative permeability ranging from about 0.002 to 0.1 were determined by fitting an analytical expression to eight of the moisture char. curves, and then integrating to solve for relative permeability. These values of relative permeability were applied to values of saturated hydraulic conductivity of core from a nearby test well to obtain effective hydraulic conductivities of about 8E-12 to 7E-10 cm/sec. If a unit hydraulic head gradient is assumed, these values convert to a vertical flux through the tuff matrix of 0.003 to 0.2 mm/yr.

NRC DOCUMENT DATA BASE

WWL Document Number: 17 Document Summary

TITLE: Geohydrologic and Drill-Hole Data for Test Well USW H-3, Yucca Mountain, Nye County, Nevada

AUTHOR: Thordarson, W., Rush, F. E., Spengler, R. W., and Waddell, S. J.

Document Number: USGS-OFR-84-149 Publication Date: 1984
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Geohydrologic Data, Drill Hole Data

KEY DATA: Water Levels, Hydraulic Tests, Fracture Distribution, Lithologic Log, Geophysical Well Logs, Injection Test, Pumping Test, Radioactive Tracer Flow Survey

COMMENTS:

SUMMARY:
The following data is presented for test well USW H-3: Bit and casing data, Lithologic log, Geophysical Well Logs, Lineations, Distribution of out of gage hole, Fracture distribution, Water Levels, Drilling Fluid Use, Pumping test data, injection test data, Recovery data, Radioactive tracer flow survey

NRC DOCUMENT DATA BASE

WWL Document Number: 18 Document Summary

TITLE: Hydrologic and Drill-Hole Data For Test Wells UE-29a#1 and UE-29a#2, Fortymile Canyon, Nevada Test Site

AUTHOR: Waddell, R. K., Jr.

Document Number: USGS-OFR-84-142 Publication Date: 1984
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Well Data, Well Tests

KEY DATA: Lithologic Log, Water Chemistry, Well Test Data, Water Levels

COMMENTS: Well test data was not analyzed in the report.

SUMMARY:
Both wells were drilled in Fortymile Canyon. Drilling difficulties caused the abandonment of UE-29a#1; drilling problems and a rig accident caused cessation of drilling of UE-29a#2 before the desired total depth was reached. Six pumping tests were performed, and water samples were collected during two series of tests in UE-29a#1. Two short term, slow pumping rate tests were performed in UE-29a#1; a water sample was collected in a subsequent period of pumping for which no drawdown data were collected.

NRC DOCUMENT DATA BASE

WWL Document Number: 21 Document Summary

TITLE: Geohydrologic Data for Test Well UE-25p#1, Yucca Mountain Area, Nye County, Nevada

AUTHOR: Craig, R. W., and Johnson, K. A.

Document Number: USGS-OFR-84-450 Publication Date: 1984
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Well Completion, Well Tests, Water Chemistry

KEY DATA: Lithologic Log, Well Construction, Water Levels, Well Tests, Water Analysis

COMMENTS: The well test data was not analyzed.

SUMMARY:
Test well UE-25p#1 was drilled to a total depth of 1,805 meters. From 1,244 to 1,805 meters the rock is dolomite of Paleozoic age. The report presents the following data for the test well: drilling operations, lithology, availability of borehole geophysical logs, water levels, water chemistry, pumping tests, borehole flow survey, and packer injection tests.

NRC DOCUMENT DATA BASE

WWL Document Number: 22 Document Summary

TITLE: Rock Property Measurements on Large-Volume Core Samples From Yucca Mountain USW GU-3/G-3 and USW G-4 Boreholes, Nevada Test Site, Nevada

AUTHOR: Anderson, L. A.

Document Number: USGS-OFR-84-552
Requested From: NRC
Received From: NRC

Publication Date: 1984
Request Date: Oct. 85
Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Core Analysis

KEY DATA: Density, Porosity

COMMENTS:

SUMMARY:
Core samples from USW GU-3/G-3 and USW G-4 boreholes were analyzed for the following; electrical resistivity, induced polarization, porosity, bulk and grain density, and compressional sonic velocity.

NRC DOCUMENT DATA BASE

WWL Document Number: 23 Document Summary

TITLE: Hydrogeologic and Hydrochemical Framework, South-Central Great Basin, Nevada-California, With Special Reference to the Nevada Test Site

AUTHOR: Winograd, I. J., and Thordarson, W.

Document Number: USGS-PP-712-C
Publication Date: 1975
Requested From: NRC
Request Date: Oct. 85
Received From: NRC
Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 9
Document Description (general, specific, etc.): General
Document Read By (Initials): TLS

KEY WORDS: Geology, Aquifers, Aquitards, Ground Water Movement, Ground Water Basins, Ground Water Chemistry, Recharge, Precipitation, Ground Water Velocity

KEY DATA: Hydrogeologic Map, Well Test, Permeability, Fracture Transmissibility, Porosity, Hydraulic Gradients, Water Analysis

COMMENTS: A good overview of the regional ground water systems.

SUMMARY:
Strata in the Nevada Test Site are divided into 10 hydrogeologic units. Three of these-the lower clastic aquitard, the lower carbonate aquifer, and the tuff aquitard- control the regional movement of ground water. Synthesis of hydrogeologic, hydrochemical, and isotopic data suggests that an area of at least 4500 square miles is hydraulically integrated into one ground water basin, the Ash Meadows basin, by interbasin movement of ground water through the widespread carbonate aquifer. Discharge from this basin-a minimum of about 17000 acre-feet annually-occurs along a fault-controlled spring line at Ash Meadows in east-central Amargosa Desert. Within the Nevada Test Site, ground water moves southward and southwestward toward Ash Meadows.

NRC DOCUMENT DATA BASE

WWL Document Number: 24 Document Summary

TITLE: Paleohydrology of the Southern Great Basin, With Special Reference to Water Table Fluctuations Beneath the Nevada Test Site During the Late(?) Pleistocene

AUTHOR: Winograd, I. J., and Doty, G. C.

Document Number: USGS-OFR-80-569 Publication Date: 1980
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Water Level, Pluvial

KEY DATA: Water Level Change

COMMENTS:

SUMMARY:
The distribution of calcitic veins in alluvium and lakebeds, and of tufa deposits, between the Ash Meadows spring discharge area and the NTS suggests that discharge from the regional Paleozoic carbonate aquifer during the Late(?) Pleistocene occurred at distances as much as 14 kilometers northeast of Ash Meadows and at altitudes up to 50 meters higher than at present.

NRC DOCUMENT DATA BASE

WWL Document Number: 25 Document Summary

TITLE: Stratigraphy and Structure of Volcanic Rocks in Drill Hole USW-G1, Yucca Mountain, Nye County, Nevada

AUTHOR: Spengler, R. W., Byers, F. M., and Warner, J. B.

Document Number: USGS-OFR-81-1349 Publication Date: 1981
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 8
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Well Completion, Stratigraphy, Core, Fractures

KEY DATA: Fracture Frequency, Well Completion Data, Lithologic Log

COMMENTS:

SUMMARY:
Drill hole USW-G1 was cored from 292 to 6000 feet. Examination of core for structural features revealed the presence of 61 shear fractures, 528 joints, and 4 conspicuous fault zones. Shear fractures mainly occurred in the TSw, flow breccia, and near fault zones. Conspicuous fault zones, arbitrarily defined by their disruption of more than 5 feet of core, were recognized by the concentration of shears coupled with the presence of fault breccia, clay gouge, and granulated core. A coincidence occurs between joint development and the degree of welding. Nearly 88 percent of shear and joint surfaces show evidence of coatings. Approximately 40 percent of the fractures were categorized as completely healed.

NRC DOCUMENT DATA BASE

WWL Document Number: 26 Document Summary

TITLE: Geohydrology of Test Well USW H-1, Yucca Mountain, Nye County, Nevada

AUTHOR: Rush, F. E., Thordarson, W., and Pyles, D. G.

Document Number: USGS-83-4032 Publication Date: 1984
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 9
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Hydraulic Head, Transmissivity, Hydraulic Conductivity, Cores, Density, Matrix Porosity, Pore Saturation, Geophysical Logs, Pump Tests, Injection Tests, Conceptual Model, Water Level, Perched Water, Chemistry

KEY DATA: Density, Matrix Porosity, Pore Saturation, Hydraulic Conductivity, Water Levels, Pump Test Data, Transmissivity, Hydraulic Conductivity, Storage, Chemical Analysis

COMMENTS: A very good report.

SUMMARY:
Based on the results of 3 pump tests, 6 injection tests, radioactive tracer surveys, hydrological monitoring, core analysis, and geophysical log interpretations; (1) Stratigraphic units from the surface through the Topopah Spring Member generally are intensively fractured, relatively porous, and unsaturated; (2) The water table is at a depth of 572 m, in the upper part of the Prow Pass Member. In the interval from 448 to 572 m, the rock is nearly saturated, probably with a perched saturated zone from 448 to 458 m. Water seeps were observed at many depths with a TV camera log; (3) For the Bullfrog Member, the average horizontal matrix hydraulic conductivity is about twice the magnitude of the avg. vertical matrix hydraulic conductivity; (4) Four zones showed temperature gradient reversals and four zones showed large increases in the temperature gradient. Hydrological conditions which may be related to the geothermal conditions have not been identified for this report. All eight zones are above the water table; (5) During drawdown and recovery tests, a slight drawdown occurred in well USW G-1, 430 m northwest; (6) Hydraulic head in the zone 688 to 741 m below surface was 730 m above sea level. Deeper zones

had hydraulic heads of 781 meters above sea level or higher, indicating an upward component of groundwater flow at the site; (7) Based on results of the pumping tests, nearly all the permeable rock penetrated by this well is in the Prow Pass Member above a depth of 688 m.

NRC DOCUMENT DATA BASE

WWL Document Number: 27 Document Summary

TITLE: Geohydrologic Data for Test Well USW G-4 Yucca Mountain Area, Nye County, Nevada

AUTHOR: Bentley, C. B.

Document Number: USGS-OFR-84-063 Publication Date: 1984
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Drilling Operations, Lithology, Pumping Tests, Injection Tests, Water Level, Water Chemistry

KEY DATA: Well Construction, Water Levels, Pumping Test, Borehole Flow Survey, Injection Test, Water Chemistry

COMMENTS: Pumping and Injection Test Data is graphically plotted as drawdown vs. time, recovery vs. time, and head above static level vs. time.

The data has not been analyzed.

SUMMARY:
This report presents data on drilling operations, lithology, borehole geophysics, hydrologic monitoring, core analysis, water chemistry, pumping tests, and packer-injection tests for test well USW G-4. Test well USW G-4 was drilled to a total depth of 915 meters. Depth of water in the well during drilling and testing ranged from 538 to 544 meters below land surface. Drawdown in the well was about 3 meters after test pumping more than 5,000 minutes at a rate of 16 liters per second. A borehole flow survey indicated that almost all water withdrawn from the well was contributed by a zone between a depth of about 865 and 915 meters below land surface. A composite water sample collected after well completion contained 216 mg/liter of dissolved solids, with relatively large concentrations of silica, sodium and bicarbonate.

NRC DOCUMENT DATA BASE

WWL Document Number: 28 Document Summary

TITLE: Geohydrologic Data for Test Well UE-25b#1 Nevada Test Site, Nye County, Nevada

AUTHOR: Lobmeyer, D. H., Whitfield, M. S., Jr., Lahoud, R. R., Bruckheimer, L.

Document Number: USGS-OFR-83-855 Publication Date: 1983
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Well Completion, Core, Well Tests

KEY DATA: Lithologic Log, Geophysical Logs, Water Levels, Well Tests, Porosity, Density, Saturation, Permeability, Water Analysis

COMMENTS:

SUMMARY:
Data on drilling operations, lithology, core analyses, borehole geophysics, hydrologic monitoring, hydraulic testing, and ground water chemistry for test well UE-25b#1 are contained in this report.

NRC DOCUMENT DATA BASE

WWL Document Number: 32 Document Summary

TITLE: Geohydrologic Data For Test Well USW H-6 Yucca Mountain Area, Nye County, Nevada

AUTHOR: Craig, R. W., Reed, R. L., and Spengler, R. W.

Document Number: USGS-OFR-83-856 Publication Date: 1984
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Well Completion, Well Tests, Water Chemistry

KEY DATA: Water Level, Well Test Data, Water Analysis

COMMENTS: The well test data was not analyzed.

SUMMARY:
Test well USW H-6 was drilled to a total depth of 1220 meters. Rocks penetrated are predominantly ash flow tuffs. Lava was encountered from 877 to 1126 meters. The composite static water level is approximately 526 meters below land surface. The well was pumped during two periods. Maximum drawdown was about 18 meters after pumping for 4822 minutes at 28 liters per second, and 12 meters after pumping for 2,226 minutes at 27 liters per second. A borehole flow survey showed that 91 percent of the water withdrawn from the well came from the depth intervals from 616 to 631 meters, and from 777 to 788 meters.

NRC DOCUMENT DATA BASE

WWL Document Number: 33 Document Summary

TITLE: Geohydrologic Data For Test Well USW H-1 Yucca Mountain Area, Nye County, Nevada

AUTHOR: Rush, F. E., Thordarson, W., and Bruckheimer, L.

Document Number: USGS-OFR-83-141 Publication Date: 1983
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 8
Document Description (general, specific, etc.): general
Document Read By (Initials): TLS

KEY WORDS: Drilling Operations, Lithologic Log, Core Samples, Well Logs, Radioactive Tracer Flow Surveys, Water Levels, Drilling Fluid, Pumping Tests, Injection Tests, Chemical Analysis

KEY DATA: Casing Data, Lithologic Log, Core Analysis, Water Levels, Drawdown Data, Recovery Data, Injection Test Data

COMMENTS:

SUMMARY:
This report presents data collected to determine the hydraulic characteristics of rocks penetrated in test well USW H-1. Data on drilling operations, lithology, borehole geophysics, hydrologic monitoring, core analysis, ground water chemistry and pumping and injection tests are contained. All data tables presented were compiled by the authors except where otherwise noted.

NRC DOCUMENT DATA BASE

WWL Document Number: 34 Document Summary

TITLE: Geohydrologic Data For Test Well USW H-5 Yucca Mountain Area, Nye County, Nevada

AUTHOR: Bentley, C. B., Robison, J. H., and Spengler, R. W.

Document Number: USGS-OFR-83-853 Publication Date: 1983
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Lithology, Pumping Tests, Injection Tests

KEY DATA: Well Construction, Lithologic Log, Water Levels, Drawdown Test, Recovery Test, Borehole Flow Survey, Injection Test

COMMENTS: Buildup, Drawdown, and Injection Test Data has not been analyzed.

SUMMARY:
The report presents data on drilling operations, lithology, borehole geophysics, water-level monitoring, core analysis, ground water chemistry, pumping tests, and packer injection tests for test well USW H-5. The well was drilled to a total depth of 1219 meters through volcanic rock consisting mostly of ash-flow tuff. Depth to water in the well ranged between 703.8 and 707.2 meters below land surface, at an approximate altitude of 774 meters above sea level. Draw-down in the well exceeded 6 meters after test pumping more than 3000 minutes at a rate of 120 liters per second. Borehole-flow surveys showed that about 90 percent of the water in the well is contributed by the zone between 707 and about 820 meters below land surface. Two composite water samples collected after well completion contained 206 and 220 milligrams per liter of dissolved solids. Sodium and bicarbonate were the predominate dissolved anion and cation. The concentration of dissolved silica was 48 milligrams per liter in both samples, which is a relatively large concentration for most natural water.

NRC DOCUMENT DATA BASE

WWL Document Number: 37 Document Summary

TITLE: Preliminary Report on the Geology and Geophysics of Drill Hole UE25a-1, Yucca Mountain, Nevada Test Site

AUTHOR: Spengler, R. W., Muller, D. C., Livermore, R. B.

Document Number: USGS-OFR-79-1244 Publication Date: 1979
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 8
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Geology, Stratigraphy, Core, Geophysical Logs

KEY DATA: Joint Inclination, Shear Fracture Inclination, Porosity, Saturation

COMMENTS:

SUMMARY:
Structural analysis of the core indicated densely welded zones to be highly fractured. Many fractures show near-vertical inclinations and are commonly coated with secondary silica, manganese and iron oxides, and calcite. Five fault zones were recognized, most of which occurred in the Topopah Spring Member. Shear fractures commonly show oblique slip movement and some suggest a sizable component of lateral compression. Graphic logs are included that show the correlation of lithology, structural properties, and geophysical logs. Many rock units have characteristic log responses but highly fractured zones, occurring principally in the Tiva Canyon and Topopah Spring Members, Restricted log coverage to the lower half of the drill hole.

NRC DOCUMENT DATA BASE

WWL Document Number: 47 Document Summary

TITLE: Minerals in Fractures of the Unsaturated Zone from Drill Core USW G-4, Yucca Mountain, Nye County, Nevada

AUTHOR: Carlos, B. Arney

Document Number: LA-10415-MS
Requested From: NRC
Received From: NRC

Publication Date: May,1985
Request Date: Oct. 85
Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Minerals, Devitrified, Zeolitized, Fracture, Static Water Level

KEY DATA: Mineral Analysis

COMMENTS:

SUMMARY:
The mineralogy of fractures in drill core USW G-4, from a depth of nearly 800 feet to the static water level (SWL) at 1770 feet, was examined to determine the sequence of deposition and the identity of minerals that might be natural barriers to radionuclide migration from a nuclear waste repository. The unsaturated zone below 244 meters was divided into three rock types: devitrified, glossy, and zeolitized host rock. Fracture-lining zeolites for each of these three rock types differ in mineralogy and morphology. Similarities between fracture mineralogy and host-rock alteration in the nonwelded zeolotic units of the Topopah Spring Member suggest that this zone was once below the water table. Nonwelded glass shards present in the host rock above the zeolite-mineral transition in the fractures indicated that the water table was never higher than the lithic-rich base of the Topopah Spring Member in the vicinity of USW G-4.

NRC DOCUMENT DATA BASE

WWL Document Number: 48 Document Summary

TITLE: Groundwater Chemistry Along Flow Paths Between a Proposed Repository Site and the Accessible Environment

AUTHOR: Ogard, A. E., and Kerrisk, J. F.

Document Number: LA-10188-MS
Requested From: NRC
Received From: NRC

Publication Date: Nov,1984
Request Date: Oct. 85
Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Ground Water Chemistry, Solubility

KEY DATA: Water Analysis, Radionuclide Solubility

COMMENTS:

SUMMARY:
The groundwater from all pumped wells in and near the site has been sampled and analyzed; the results are reported in this document. The speciation and solubility of nuclear waste elements in these ground waters have been calculated using the EQ3/6 computer code. Estimates have also been made of the pH and Eh buffering capacity of the water/rock system of Yucca Mountain.

NRC DOCUMENT DATA BASE

WWL Document Number: 51 Document Summary

TITLE: Solubility Limits on Radionuclide Dissolution at a Yucca Mountain Repository

AUTHOR: Kerrisk, J. F.

Document Number: LA-9995-MS
Requested From: NRC
Received From: NRC
Publication Date: May,1984
Request Date: Oct. 85
Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 8
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Water Chemistry, Solubility, Conceptual Model

KEY DATA: Water Analysis, Radionuclide Solubility, Repository Inventory

COMMENTS:

SUMMARY:
This report examines the effects of solubility in limiting dissolution rates of a number of important radionuclides from spent fuel and high level waste. Two simple dissolution models were used for calculations that are characteristic of a Yucca Mountain repository. A saturation limited dissolution model, in which the water flowing through the repository is assumed to be saturated with each waste element, is very conservative in that it over estimates dissolution rates. A diffusion limited dissolution model, in which element dissolution rates are limited by diffusion of waste elements into water flowing past the waste, is more realistic, but it is subject to some uncertainty at this time.

NRC DOCUMENT DATA BASE

WWL Document Number: 56

Document Summary

TITLE: Fracture and Matrix Hydrologic Characteristics of Tuffaceous Materials from Yucca Mountain, Nye County, Nevada

AUTHOR: Peters, R. R., Klavetter, E. A., Hall, I. J., Blair, S. C., Heller, P. R., and Gee, G. W.

Document Number: SAND84-1471
Requested From: NRC
Received From: NRC

Publication Date: Dec,1984
Request Date: Oct. 85
Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 8
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Core Analysis, Fracture Analysis,

KEY DATA: Matrix Permeability, Fracture Permeability

COMMENTS:

SUMMARY:
The primary purpose of this document is to provide a compilation of the testing procedures used and the hydrologic data obtained. The results of testing indicate the following; (1) There are wide variations in water retention characteristics for the tuffaceous materials tested. (2) The measured saturated hydraulic conductivities for welded tuff samples were low, ranging from 10E-10 to 10E-14 m/s. The fracture saturated conductivity was significantly higher than the matrix conductivity on all samples tested and flow through all fractured and unfractured samples was reduced at elevated pressure.

NRC DOCUMENT DATA BASE

WWL Document Number: 57 Document Summary

TITLE: Unit Evaluation at Yucca Mountain, Nevada Test Site: Summary Report and Recommendation

AUTHOR: Johnstone, J. K., Peters, R. R., and Gnirk, P. F.

Document Number: SAND83-0372 Publication Date: June,1984
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 8
Document Description (general, specific, etc.): Overview
Document Read By (Initials): TLS

KEY WORDS: Conceptual Model, Numerical Model, Ground Water Flow

KEY DATA: Stratigraphy, Hydraulic Head Distribution, Recharge

COMMENTS:

SUMMARY:
Pacific Northwest Laboratory documented the data requirements, boundary conditions, and calibration of a two dimensional, finite difference, hydrologic model of the NTS and vicinity. Underflow from areas north and east of the model boundary contribute a significant flux to model input; however, water balances within the model boundary are in good agreement with published values. The major discharge flux from the model occurs along the Death Valley perimeter. If future hydraulic head data and aquifer tests were identified with hydrostratigraphic units, a two layer, three dimensional model could be constructed, which would more accurately simulate the physical system.

NRC DOCUMENT DATA BASE

WWL Document Number: 64 Document Summary

TITLE: Bulk and Thermal Properties of the Functional Tuffaceous Beds in Holes USW G-1, UE-25a#1, and USW G-2, Yucca Mountain, Nevada

AUTHOR: Lappin, A. R., and Nimick, F. B.

Document Number: SAND82-1434 Publication Date: April,1985

Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 8
Document Description (general, specific, etc.): specific
Document Read By (Initials): TLS

KEY WORDS: Grain Density, Porosity, Frequency Distributions, Mineralogy, Thermal Conductivity, Thermal Expansion, Dehydration

KEY DATA: Grain Density, Porosity, Thermal Conductivity, Thermal Expansion

COMMENTS:

SUMMARY:
The objective of this report is to document bulk and thermal property data used in evaluating the Tuffaceous Beds of Calico Hills. Only data received as of March 15, 1982 are included. A Functional Unit is defined using zeolitization as a prime characteristic. The Functional Unit includes portions of the overlying and underlying tuffs. Thermal conductivity measurements on zeolitized ashflow tuffs are relatively consistent, indicating a zero porosity conductivity of 1.95 W/m*K. Internal complexity of the functional Tuffaceous Beds is apparent in thermal expansion behavior. On cooling, the expansion behavior of these strongly zeolitized tuffs depends on the availability of water. If the tuffs are not rehydrated, they will contract continuously to ambient temperature, resulting in net contraction if they are dewatered on heating.

NRC DOCUMENT DATA BASE

WWL Document Number: 65

Document Summary

TITLE: Water Transport Through Welded Tuff

AUTHOR: Hadley, G. R.

Document Number: SAND82-1043
Requested From: NRC
Received From: NRC

Publication Date: Aug,1984
Request Date: Oct. 85
Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): specific
Document Read By (Initials): TLS

KEY WORDS: Imbibition, Evaporation Front, Capillary Forces, Vapor Pressure Gradients, Gamma Ray Densiometry, Saturation Profiles

KEY DATA: Porosity, Saturation Profiles

COMMENTS: The report presents an interesting method for determining the saturation profile in a rock sample by the use of gamma ray attenuation.

SUMMARY:
The direct measurement of saturation profiles in tuff cores during drying and imbibition is discussed. Much information on the experimental procedures and apparatus is given. The results of the experiments showed that the shapes of the saturation profiles in the 0.15 meter long core of welded tuff depend on the presence and direction of the sample temperature gradient. The profiles indicate that drying takes place simultaneously throughout the sample, and not from an isolated region, such as an evaporation front.

NRC DOCUMENT DATA BASE

WWL Document Number: 66

Document Summary

TITLE: Reduction of the Well Test Data for Test Well USW H-1, Adjacent to Nevada Test Site, Nye County, Nevada

AUTHOR: Barr, G. E.

Document Number: SAND84-0637
Requested From: NRC
Received From: NRC

Publication Date: May,1985
Request Date: Oct. 85
Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 8
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Pump Tests, Injection Tests, Hydraulic Conductivity, Storativity, Computer Code, Sensitivity Analysis, Barrier, Drawdown, Recovery

KEY DATA: Test Intervals, Pumping Rate, Injection Rate, Hydraulic Conductivity, Storativity

COMMENTS: Contains computer code used for data reduction

SUMMARY:
The data from 3 pump tests, 3 recovery tests, and 6 injection tests are reduced by a computer program to determine hydraulic conductivity,storativity, and any source/ boundary conditions. The computer code PUMP, allows investigations of the sensitivity of the results due to changes in K and S and of the subsurface location of possible water sources or barriers. The model assumes no vertical infiltration occurs and that the medium is vertically homogeneous. It is necessary to assume starting values for K and S. By trial and error, values of K and S can be found which give and approx. fit between the calculated and the observed data. The integrated total hydraulic conductivity of the penetrated portion of the saturated zone is essentially the same as determined in WWLNUM 26 by Rush et.al, using graphical methods. However, some individual tests differ by a factor of 10 for K. The upper zone is characterized by relatively high hydraulic conductivities, in the range of 1E-4 to 1E-5 m/sec, with some indication of fracture connectivity. Below this zone, the volcanic rocks appear to be less conductive by several orders of magnitude.

NRC DOCUMENT DATA BASE

WWL Document Number: 73 Document Summary

TITLE: Hydrologic Mechanisms Governing Fluid Flow in Partially Saturated, Fractured, Porous Tuff at Yucca Mountain

AUTHOR: Wang, J. S. Y., and Narasimhan, T. N.

Document Number: SAND84-7202 Publication Date: April,1985

Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 9
Document Description (general, specific, etc.): General
Document Read By (Initials): TLS,LAD,DBM

KEY WORDS: Hydrologic Model, Fracture Flow, Unsaturated Flow, Capillary Barrier, Hysteresis, Vapor Transport

KEY DATA: Hydrologic properties of Hydrogeologic Units

COMMENTS:

SUMMARY:
A conceptual model describing the flow of fluids through the unsaturated zone at Yucca Mountain is proposed. The proposed model considers the following flow phenomena in the unsaturated region; flow through fractured rock, capillary barriers, infiltration into fractured rock, lateral movement, and capillary fringe. The proposed model gives a representation of the flow in the hydrogeologic units and structural pathways at Yucca Mountain. Areas needing further investigation are identified.

NRC DOCUMENT DATA BASE

WWL Document Number: 74 Document Summary

TITLE: Hydrology and Water Resources Overview for the Nevada Nuclear Waste Storage Investigations, Nevada Test Site, Nye County, Nevada

AUTHOR: French, R. H., Elzeftawy, A., Bird, J., and Elliot, B.

Document Number: NVO-284
Requested From: NRC
Received From: NRC

Publication Date: June,1984
Request Date: Oct. 85
Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Overview
Document Read By (Initials): TLS

KEY WORDS: Groundwater, Paleoclimatology, Hydrometeorology

KEY DATA: Water Analysis, Water Usage, Precipitation

COMMENTS:

SUMMARY:
This report summarizes the literature and available unpublished data regarding hydrology and water resources utilization in the NTS area.

NRC DOCUMENT DATA BASE

WWL Document Number: 75 Document Summary

TITLE: Geology and Hydrology of Yucca Mountain and Vicinity, Nevada Test Site

AUTHOR: Reade, M. T., and McKay, E. D.

Document Number: CGS/8116R028
Requested From: NRC
Received From: NRC

Publication Date: Mar,1982
Request Date: Oct. 85
Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Overview
Document Read By (Initials): TLS

KEY WORDS: Geology, Regional Hydrology

KEY DATA: Porosity, Permeability, Fracture Properties

COMMENTS:

SUMMARY:
This report provides a summary of the geology and hydrology from available studies of the NTS region for the purpose of allowing application of the Sandia risk assessment methodology to a realistic geologic system in which volcanic tuffs are the candidate disposal medium. The probability and consequences of the occurrence of several scenarios are considered.

NRC DOCUMENT DATA BASE

WWL Document Number: 76 Document Summary

TITLE: Draft Environmental Assessment Yucca Mountain Site, Nevada Research and Development Area, Nevada

AUTHOR: DOE Office of Civilian Radioactive Waste Management

Document Number: DOE/RW-0012 Publication Date: Dec,1984
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Overview
Document Read By (Initials): TLS

KEY WORDS: Hydrology, Geohydrology, Geochemistry, Dissolution, Erosion, Tectonics, Meteorology, Drainage Basins, Exploratory Shaft, Transportation

KEY DATA: Ground water travel time, Sorption Ratios, Water Chemistry, Cross Sections, Maps, Bibliography

COMMENTS: The Department of Energy's Evaluation of the Yucca Mountain Site

SUMMARY:
A great deal of assumptions have been made by the DOE to justify the suitability of Yucca Mountain for site characterization and for development as a repository. The crux of the evaluation and subsequent recommendations are given in Chapter 6. Since the characterization of the site is not complete, much of the current description draws heavily from previous studies of the NTS and of the southern Nevada region. Potential geohydrological impacts which have been pointed out by the DOE include the following: cyclic pluvial conditions may lead to an increase in the level of the water table; sufficient data on stratigraphic, structural, and hydrological features are not yet available to model the site with reasonable certainty; it has not been determined if the geohydraulic unit above the host rock will divert the downward flow of water beyond the limits of the emplaced wastes. The major areas which still need to be investigated are: the amount of recharge, the related ground water flux through the unsaturated zone, the mechanisms by which water moves in densely welded, fractured tuffs (unsaturated); representative values for hydraulic conductivities and moisture contents of various rocks transversed by ground water, and effective porosities.

NRC DOCUMENT DATA BASE

WWL Document Number: 81 Document Summary

TITLE: Nevada Nuclear Waste Storage Investigations Project Monthly Report August 1985

AUTHOR: Department of Energy

Document Number:
Requested From: NRC
Received From: NRC

Publication Date: Aug,1985
Request Date: Oct. 85
Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Update
Document Read By (Initials): TLS

KEY WORDS: Monthly Report

KEY DATA:

COMMENTS:

SUMMARY:
The report provides a general review for the many projects which are underway.

NRC DOCUMENT DATA BASE

WWL Document Number: 82 Document Summary

TITLE: Hydrology and Water Resources Overview for the Nevada Nuclear Waste Storage Investigations, Nevada Test Site, Nye County, Nevada: Annotated Bibliography

AUTHOR: French, R. H., Elzeftawy, A., and Elliot, B.

Document Number: NVO-283
Requested From: NRC
Received From: NRC

Publication Date: June,1984
Request Date: Oct. 85
Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 8
Document Description (general, specific, etc.): Overview
Document Read By (Initials): TLS

KEY WORDS: Bibliography

KEY DATA: Bibliography

COMMENTS: The report lists 344 references which pertain to the NNWSI.

SUMMARY:
The bibliography is organized in alphabetical order and the citation format is that recommended by the American Society of Civil Engineers. It should be noted that, in isolated cases, annotations were extracted from other annotated bibliographies and the actual publication was not examined by the authors.

NRC DOCUMENT DATA BASE

WWL Document Number: 83 Document Summary

TITLE: Regional Ground-Water Systems in the Nevada Test Site Area, Nye, Lincoln, and Clark Counties, Nevada

AUTHOR: Rush, F. E

Document Number: USGS Report 54
Requested From: NRC
Received From: NRC

Publication Date: 1971
Request Date: Oct. 85
Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 6
Document Description (general, specific, etc.): Overview
Document Read By (Initials): TLS

KEY WORDS: Geology, Climate, Ground Water Basin

KEY DATA: Precipitation, Recharge

COMMENTS:

SUMMARY:
Three regional interbasin ground water flow systems have been identified: The Ash Meadows system in the eastern two-thirds of the area, the Pahute Mesa system in the western third, and the Sarcobatus Flat system west of the study area and including Cactus Flat.

NRC DOCUMENT DATA BASE

WWL Document Number: 85 Document Summary

TITLE: Preliminary Estimates of Water Flow and Radionuclide Transport in Yucca Mountain

AUTHOR: Travis, B. J., Hodson, S. W., Nuttall, H. E., Cook, T. L., and Rundberg, R. S.

Document Number: LA-UR-84-40 Publication Date: 1984
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 8
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Computer Code, Fracture Flow, Radionuclide Transport, Radionuclide Adsorption, Relative Permeability, Heat Load Effect

KEY DATA: Radionuclide Retardation Factors, Radionuclide Diffusivity, Relative Permeability

COMMENTS:

SUMMARY:
The report looks at the effect of lithology and the presence of fractures on water flow and radionuclide transport in Yucca Mountain. Two computer codes were used in the analysis: (1) TRACR3D, which computes saturated and unsaturated two phase flow in fractured porous media, and (2) WAFE, which computes water, air, vapor, and energy movement in porous media. Plots of crack width vs. depth reached by a water slug for various matrix saturations and diffusion coefficients were generated. Migration histories for ten radionuclides through four stratigraphic units (Topopah Spring, Bedded Tuff, Calico Hills, Prow Pass) are presented. Some of the conclusions stated: (1) Significant fracture flow can occur above the water table, but only through high-saturation, low permeability tuff (2) Diffusion into the matrix and adsorption have a profound effect on transport. None of the radionuclides considered reaches the accessible environment in less than 10,000 years. (3) Heat load in partially saturated tuff can result in a dry, steam-filled region extending several meters above and below a repository with recharge during cooldown phase.

NRC DOCUMENT DATA BASE

WWL Document Number: 86 Document Summary

TITLE: Identification and Characterization of Hydrologic Properties of Fractured Tuff Using Hydraulic and Tracer Tests--Test Well USW H-4, Yucca Mountain, Nye County, Nevada

AUTHOR: Erickson, J. R., and Waddell, R. K.

Document Number: USGS-85-4066 Publication Date: 1985
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 8
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Injection Tests, Tracer Tests, Fracture Distribution

KEY DATA: Fracture Intervals, Flow Intervals, Temperature Survey, Fracture Porosity

COMMENTS:

SUMMARY:
Intrawell bore flow velocities were measured at & locations using a short duration radioactive tracer. Other fractures were identified using temperature and borehole flow surveys. The fractures were correlated with an acoustic televiewer log, which showed that 86.2% of the identified fractures in the saturated zone have strikes ranging from N10W to N55E, with dips ranging from 50 to 86. A TV camera log showed some fractures with strikes from N15W to N55W. Radioactive tracer flow surveys indicate that less than 21% of the total saturated section contributed measurable quantities of water to the well bore. The flow points identified from the temperature log during pumping correlated with the location of fractures. However, the majority of the fractures had no detectable flow. The results of the fracture analysis indicate that water was produced predominately from northeast trending fractures. In general, good correlation exists between zones determined to be permeable by different techniques, however, no single technique was capable of producing sufficient information to characterize distribution of permeability and direction of movement within the borehole. The results presented indicate that in detail, the ground water flow characteristics of the fractured tuff at Yucca Mountain are complex.

NRC DOCUMENT DATA BASE

WWL Document Number: 87

Document Summary

TITLE: Geohydrologic Data and Test Results From Well J-13, Nevada Test Site, Nye County, Nevada

AUTHOR: Thordarson, W

Document Number: USGS-83-4171
Requested From: NRC
Received From: NRC

Publication Date: 1983
Request Date: Oct. 85
Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 8
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Geology, Lithology, Well Tests, Water Chemistry

KEY DATA: Well Construction, Lithologic Log, Porosity, Saturation, Water Level, Well Test Data, Water Analysis

COMMENTS:

SUMMARY:
Well J-13 was drilled to a depth of 1063.1 meters by using air hydraulic rotary drilling equipment. The Topopah Spring unit was found to be the principal aquifer. Below the TSw unit, tuff units are confining beds; transmissivities range from 0.1 to 4.5 meters squared per day. A static water level of approximately 282.2 meters was measured for the various water bearing tuff units above a depth of 645.6 meters. Below a depth of 772.7 meters, the static water level was slightly deeper. The apparent age of the ground water, derived from carbon-14 age dating, is 9,900 years.

NRC DOCUMENT DATA BASE

WWL Document Number: 90 Document Summary

TITLE: Nevada Nuclear Waste Storage Investigations Project Monthly Report September, 1985

AUTHOR: Department of Energy

Document Number:
Requested From: NRC
Received From: NRC

Publication Date: Sep,1985
Request Date: Oct. 85
Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): General
Document Read By (Initials): TLS

KEY WORDS:

KEY DATA:

COMMENTS: Presents the current status for the various projects relating to NNWSI.

SUMMARY:

NRC DOCUMENT DATA BASE

WWL Document Number: 91 Document Summary

TITLE: A Three-Dimensional Model of Reference Thermal/Mechanical and Hydrological Stratigraphy at Yucca Mountain, Southern Nevada

AUTHOR: Ortiz, T. S., Williams, R. L., Nimick, F. B., Whittet, B. C., and South, D. L.

Document Number: SAND84-1076 Publication Date: Oct,1985
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): general
Document Read By (Initials): TLS

KEY WORDS: Model, Graphics, CAD, Faults, Surface, Stratigraphy, Strike,Slip,Density, Porosity, X-ray, Logs, Zeolite, Units, Gyroscopic Survey, Cross-section, Tuff, Water Table, Vitrophyre

KEY DATA: Cross Sections, Isopach Maps, Water Table Surface, Fault Angles, Dip

COMMENTS:

SUMMARY:
A 3-D model of the thermal/mechanical and hydrological reference stratigraphy at Yucca Mountain has been developed for use in performance assessment and repository design studies involving material properties data. The reference stratigraphy defines units with distinct thermal, physical, mechanical, and hydrological properties. The model is a collection of surface representations, each surface representing the base of a particular unit. The reliability of the model was evaluated by comparing the generated surfaces, existing geologic maps and cross sections, drill hole data, and geologic interpretation. Interpolation of surfaces between drill holes by the model closely matches the existing information.

NRC DOCUMENT DATA BASE

WWL Document Number: 92 Document Summary

TITLE: Reaction of the Topopah Spring Tuff with J-13 Well Water at 90 C and 150 C

AUTHOR: Oversby, V. M.

Document Number: UCRL-53552
Requested From: NRC
Received From: NRC

Publication Date: May,1984
Request Date: Oct. 85
Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): specific
Document Read By (Initials): TLS

KEY WORDS: Topopah Spring Tuff, J-13 Well WAter, Cristobalite Solubility, Anion, Cation, Alkalinity, Steady State, Water Chemistry

KEY DATA: Water analysis for J-13 well water and reaction water, Steady state estimate of water chemistry

COMMENTS:

SUMMARY:
The reaction of Topopah Springs Tuff (Tpt) with J-13 well water was conducted using Tpt collected from Fran Ridge, which is several miles east of Yucca Mountain. The Tpt samples were crushed and combined with J-13 well water in Teflon lined reaction vessels, in four rock to water weight ratios. The experiments were run at 90 C and 150 C for reaction times up to 72 days. None of the experiments reached steady state solution concentration. Long term experiments were in progress to determine the steady state chemistry. However, an estimated water chemistry at steady state for 90 C and 150 C is given in Table 54.

NRC DOCUMENT DATA BASE

WWL Document Number: 93 Document Summary

TITLE: Chemical Composition of Ground Water and the Locations of Permeable Zones in the Yucca Mountain Area, Nevada

AUTHOR: Benson, L. V., Robison, J. H., Blankennagel, R. K., and Ogard, A. E.

Document Number: USGS-OFR-83-854
Publication Date: May,1984
Requested From: NRC
Request Date: Oct. 85
Received From: NRC
Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 5
Document Description (general, specific, etc.): specific
Document Read By (Initials): TLS

KEY WORDS: Water chemistry, cation, anion, carbon-14, tracer, flow survey, permeable zones

KEY DATA: Well construction, flow surveys, water level, water chemistry

COMMENTS: Poorly written paper.

SUMMARY:
Ten wells on or near Yucca Mountain were sampled for chemical analysis including carbon-14 dating. Significant differences were found in uncorrected carbon-14 age and in inorganic and stable isotope composition. A lithium tracer was used with the drilling fluids to measure the extent of infiltration. The majority of the water samples contained less than about 0.4 percent drilling fluid. The source for drilling water on all but one well was J-13. Borehole surveys were conducted using an injector type tool with 131 I as the tracer. Pump rates while the surveys were being performed are not given. The only wells listed where the Tpt lies below the water table are J-12 and J-13. On these wells, water injection tests using packers indicated most of the production comes from the Tpt.

NRC DOCUMENT DATA BASE

WWL Document Number: 99 Document Summary

TITLE: Rock Property Analysis of Core Samples from the Yucca Mountain UE25a-1 Borehole, Nevada Test Site, Nevada

AUTHOR: Anderson, L. A.

Document Number: USGS-OFR-81-1338 Publication Date: 1981
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Core Analysis

KEY DATA: Porosity, Permeability

COMMENTS:

SUMMARY:
Core samples from the Yucca Mountain UE25a-1 borehole were measured for bulk density, porosity, resistivity, induced polarization, compressional sonic velocity, permeability, magnetic susceptibility, and remanent magnetization as part of a large scale site evaluation program. There is no direct correlation between porosity and permeability; the latter varying widely and often decreasing with time as unconsolidated particles within the pore network are repositioned so as to impede the continued flow of water through the rock.

NRC DOCUMENT DATA BASE

WWL Document Number: 104 Document Summary

TITLE: Geology of Drill Hole USW VH-2, and Structure of Crater Flat, Southwestern Nevada

AUTHOR: Carr, W. J. and Parrish, L. D.

Document Number: USGS-OFR-85-475 Publication Date: 1985
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 8
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Well Construction, Stratigraphy, Lithology

KEY DATA: Lithologic Log

COMMENTS:

SUMMARY:
A 1219 meter drill hole in Crater Flat shows the absence of buried Pliocene or Quaternary volcanic rocks, and penetrates a section of Timber Mountain, Paintbrush, and the upper part of the Crater Flat Tuffs, similar to that exposed adjacent to Crater Flat.

NRC DOCUMENT DATA BASE

WWL Document Number: 110 Document Summary

TITLE: Sources and Mechanisms of Recharge for Ground Water in the West-Central Amargosa Desert, Nevada--A Geochemical Interpretation

AUTHOR: Claassen, H. C.

Document Number: USGS-OFR-83-542 Publication Date: 1983
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): General
Document Read By (Initials): TLS

KEY WORDS: Ground Water Geochemistry

KEY DATA: Water Analysis

COMMENTS:

SUMMARY:
Ground water in the west-central Amargosa Desert, Nevada, was recharged primarily by overland flow of snowmelt in or near the present day stream channels, rather than by subsurface flow from highland recharge areas to the north. Geochemical arguments, including reaction mechanisms, are used to support these findings. Carbon-, hydrogen-, and oxygen-isotope data show that much of the recharge in the area occurred during late Wisconsin time. Absence of ground water recharged prior to late Pleistocene is considered to indicate that either climatic conditions were unfavorable for recharge or that ground-water velocities were such that they transported this earlier recharge away from the study area.

NRC DOCUMENT DATA BASE

WWL Document Number: 116 Document Summary

TITLE: Summary Report on the Geochemistry of Yucca Mountain and Environs

AUTHOR: Daniels, W. R., et al.

Document Number: LA-9328-MS
Requested From: NRC
Received From: NRC
Publication Date: Dec,1982
Request Date: Oct. 85
Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 8
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Ground Water Geochemistry, Retardation, Modeling

KEY DATA: Water Analysis, Sorption Ratios, Petrology, Cation Exchange Capacity, Permeability, Porosity, Fracture Flow Properties, Thermodynamic Data, Solubility

COMMENTS: An extensive report.

SUMMARY:
This report gives a detailed description of work at Los Alamos that will help resolve geochemical issues pertinent to siting a high-level nuclear waste repository in tuff at Yucca Mountain. It is necessary to understand the properties and setting of the host tuff because this rock provides the first natural barrier to migration of waste elements from a repository. The geochemistry of tuff is being investigated with particular emphasis on retardation processes. This report addresses the various aspects of sorption by tuff, physical and chemical makeup of tuff, diffusion processes, tuff/groundwater chemistry, waste element chemistry under expected repository conditions, transport processes involved in porous and fracture flow, and geochemical and transport modeling.

NRC DOCUMENT DATA BASE

WWL Document Number: 120 Document Summary

TITLE: Preliminary Assessment of In-Situ Geomechanical Characteristics in Drill Hole USW G-1, Yucca Mountain, Nevada

AUTHOR: Ellis, W. L. and Swolfs, H. S.

Document Number: USGS-OFR-83-401 Publication Date: 1983
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 8
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Geology, Borehole Observations, Fracture

KEY DATA: Drilling Fluid Loss, Fracture Frequency,

COMMENTS:

SUMMARY:
Substantial drilling fluid losses, and the occurrence of drilling induced fracturing, are understandable in terms of the low, minimum horizontal stress magnitudes interpreted from six hydraulic-fracturing stress measurements conducted between hole depths of 640 and 1300 meters. Although not confirmed directly by the hydraulic fracturing data, other observations suggest that the minimum stress magnitudes in the more densely welded and brittle tuff layers may be even smaller than in the less welded and more ductile rocks.

NRC DOCUMENT DATA BASE

WWL Document Number: 123

Document Summary

TITLE: Bibliography of Reports by U.S. Geological Survey Personnel Pertaining to Underground Nuclear Testing and Radioactive Waste Disposal at the Nevada Test Site, and Radioactive Waste Disposal at the Waste Isolation Pilot Plant Site, New Mexico

AUTHOR: Glanzman, V. M.

Document Number: USGS-OFR-81-892
Publication Date: 1981
Requested From: NRC
Request Date: Oct. 85
Received From: NRC
Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Overview
Document Read By (Initials): TLS

KEY WORDS: Bibliography

KEY DATA: Bibliography

COMMENTS:

SUMMARY:
The bibliography lists reports released to the public between January 1, 1980, and December 31, 1980, by personnel of the USGS. Reports include information on underground nuclear testing and waste management projects at the NTS and radioactive waste projects at the WIPP site, New Mexico.

NRC DOCUMENT DATA BASE

WWL Document Number: 124 Document Summary

TITLE: Bibliography of Reports by U.S. Geological Survey Personnel Pertaining to Underground Nuclear Testing and Radioactive Waste Disposal at the Nevada Test Site, and Radioactive Waste Disposal at the Waste Isolation Pilot Plant Site, New Mexico.

AUTHOR: Glanzman, V. M.

Document Number: USGS-OFR-80-817 Publication Date: 1980
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Overview
Document Read By (Initials): TLS

KEY WORDS: Bibliography

KEY DATA: Bibliography

COMMENTS:

SUMMARY:
This bibliography presents reports released to the public between January 1, 1979, and December 31, 1979, by personnel of the USGS. Reports include information on underground nuclear testing and waste management projects at the NTS and radioactive waste projects at the WIPP site, New Mexico.

NRC DOCUMENT DATA BASE

WWL Document Number: 125

Document Summary

TITLE: Bibliography of Reports by U.S. Geological Survey Personnel Pertaining to Underground Nuclear Testing and Radioactive Waste Disposal at the Nevada Test Site, and Radioactive Waste Disposal at the Waste Isolation Pilot Plant Site, New Mex

AUTHOR: Glanzman, V. M.

Document Number: USGS-OFR-83-478
Publication Date: 1983
Requested From: NRC
Request Date: Oct. 85
Received From: NRC
Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Overview
Document Read By (Initials): TLS

KEY WORDS: Bibliography

KEY DATA: Bibliography

COMMENTS:

SUMMARY:
This bibliography lists reports by personnel of the USGS released to the public between January 1, 1981, and December 31, 1981. Reports include information on underground nuclear testing and waste management projects at the NTS and radioactive waste projects at the WIPP site, New Mexico.

NRC DOCUMENT DATA BASE

WWL Document Number: 126 Document Summary

TITLE: Bibliography of Reports by U.S. Geological Survey Personnel Pertaining to Underground Nuclear Testing and Radioactive Waste Disposal at the Nevada Test Site, and Radioactive Waste Disposal at the Waste Isolation Pilot Plant Site, New Mex

AUTHOR: Glanzman, V. M.

Document Number: USGS-OFR-85-363 Publication Date: 1985
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Nov. 85

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Overview
Document Read By (Initials): TLS

KEY WORDS: Bibliography

KEY DATA: Bibliography

COMMENTS:

SUMMARY:
The bibliography lists reports by personnel of the USGS released to the public between January 1, 1983, and December 31, 1984. Reports include information on underground nuclear testing and waste management projects at the NTS and radioactive waste projects at the WIPP site, New Mexico.

NRC DOCUMENT DATA BASE

WWL Document Number: 148 Document Summary

TITLE: Stratigraphy, Structure, and Some Petrographic Features of Tertiary Volcanic Rocks at the USW G-2 Drill Hole, Yucca Mountain, Nye County, Nevada

AUTHOR: Maldonado, F. and Koether, S. L.

Document Number: USGS-OFR-83-732 Publication Date: 1983
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Dec,1985

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Stratigraphy, Core Analysis, Well Completion

KEY DATA: Well Completion, Stratigraphy, Fracture Analysis, Lithologic Log

COMMENTS:

SUMMARY:
A fracture analysis of the core resulted in tabulation of 7848 fractures, predominately open and high angle. The fractures were filled or coated with material in various combinations. Numerous fault zones were penetrated by the drill hole, predominately in the lithophysal zone to the Topopah Spring Member and below the tuffaceous beds of Calico Hills.

NRC DOCUMENT DATA BASE

WWL Document Number: 151 Document Summary

TITLE: Nevada Nuclear Waste Storage Investigations Environmental Area Characterization Report

AUTHOR: The MITRE Corporation

Document Number: SAND83-7132 Publication Date: July,1984
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Dec,1985

Document Rating (1=poor to 10=excellent): 6
Document Description (general, specific, etc.): Overview
Document Read By (Initials): TLS

KEY WORDS: Atmosphere, Climate, Energy Resources, Water Supplies

KEY DATA: Precipitation, Hydrologic Units, Water Use,

COMMENTS:

SUMMARY:
The report describes the southwestern corner of the Nevada Test Site, Nye County, Nevada, a potential location for a geologic repository for a high-level radioactive waste. The characterization summarizes reports supplied by Sandia National Laboratories, which cover the following topics: atmosphere, radiation background, hydrosphere, biosphere, energy and mineral resources, socio-economics, and cultural resources.

NRC DOCUMENT DATA BASE

WWL Document Number: 152

Document Summary

TITLE: Permeability and Fluid Chemistry Studies of the Topopah Spring Member of the Paintbrush Tuff, Nevada Test Site: Part II

AUTHOR: Moore, D. E., Morrow, C. A., and Byerlee, J. D.

Document Number: UCRL-15667

Publication Date: March,1985

Requested From: NRC

Request Date: Oct. 85

Received From: NRC

Receipt Date: Dec,1985

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Fluid Chemistry, Permeability,

KEY DATA: Water Analysis, Reaction States

COMMENTS:

SUMMARY:
A series of permeability experiments has been conducted to model the flow of groundwater away from canisters heated by radioactive decay at a nuclear waste disposal site in tuffaceous rock. The purpose of the study was to determine the effects of localized heating around the canisters on the repository rock and associated groundwater. Studies concentrated on two tuff units from the NTS : the Bullfrog Member of the Crater Flat Tuff, and the Topopah Spring Member of the Paintbrush Tuff. This paper reports the permeability and groundwater chemistry results for the Topopah Spring Member and compares those results with the previous work on Bullfrog.

NRC DOCUMENT DATA BASE

WWL Document Number: 159 Document Summary

TITLE: Reaction of Bullfrog Tuff with J-13 Well Water at 90 C and 150 C

AUTHOR: Oversby, V. M. and Knauss, K. G.

Document Number: UCRL-53442 Publication Date: Sept,1983
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Dec,1985

Document Rating (1=poor to 10=excellent): 8
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Reaction Chemistry

KEY DATA: Water Analysis

COMMENTS:

SUMMARY:
A series of experiments were conducted to determine the nature and extent of reaction between the Bullfrog Member of the Crater Flat tuff and natural groundwater from well J-13 at the NTS. The experiments were conducted on crushed tuff at 90 and 150 degrees C and on core wafer samples at 150 degrees C. The paper presents the data for a number of ions in solution and for the pH of solutions. Additionally, it outlines the various experimental conditions used to determine the effects of different sample weights relative to solution volume, length of reaction time, presence and nature of highly soluble components, filtration of samples, agitation of samples during reaction, and method of sample preparation.

NRC DOCUMENT DATA BASE

WWL Document Number: 162 Document Summary

TITLE: Hydrologic Test System for Fracture Flow Studies in Crystalline Rock

AUTHOR: Raber, E., Lord, D., and Burklund, P.

Document Number: UCID-19405 Publication Date: May,1982
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Dec,1985

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Fracture

KEY DATA: None

COMMENTS:

SUMMARY:
A hydrologic test system has been designed to measure the intrinsic permeabilities of individual fractures in crystalline rock. This system is used to conduct constant pressure-declining flow rate and pressure pulse hydraulic tests. The system is composed of four distinct units: (1) The Packer System, (2) Injection System, (3) Collection System and (4) Electronic Data Acquisition System. The apparatus is built in modules so it can be easily transported and re-assembled. It is also designed to operate over a wide range of pressures (0-300 psig) and flow rates (0.2 - 1.0 gal/min).

NRC DOCUMENT DATA BASE

WWL Document Number: 164 Document Summary

TITLE: Radionuclide Migration: Laboratory Experiments With Isolated Fractures

AUTHOR: Rundberg, R. S., Thompson, J. L., and Maestas, S.

Document Number: LASL
Requested From: NRC
Received From: NRC

Publication Date: Nov,1981
Request Date: Oct. 85
Receipt Date: Dec,1985

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Fracture Flow, Radionuclide Transport

KEY DATA: Breakthrough Curves

COMMENTS:

SUMMARY:
Laboratory experiments have been run on fractures ranging in size from 1 to 20 cm in length. The hydraulic flow in these fractures was studied to provide the effective apertures. Traced solutions containing Strontium and Cesium were flowed through fractures in Climax Stock granite and welded tuff. The results of the elutions through granite agree with the matrix diffusion calculations based on independent measurements of Kd. The results of the elutions through tuff, however, agree only if the Kd values used in the calculations are lower than the Kd values measured using a batch technique. This trend has been previously observed in chromatographic column experiments with tuff.

NRC DOCUMENT DATA BASE

WWL Document Number: 169 Document Summary

TITLE: Stratigraphic and Structural Characteristics of Volcanic Rocks in Core Hole USW G-4, Yucca Mountain, Nye County, Nevada

AUTHOR: Spengler, R. W. and Chornack, M. P.

Document Number: USGS-OFR-84-789
Publication Date: 1984
Requested From: NRC
Request Date: Oct. 85
Received From: NRC
Receipt Date: Dec,1985

Document Rating (1=poor to 10=excellent): 9
Document Description (general, specific, etc.): Specific
Document Read By (Initials): TLS

KEY WORDS: Drilling History, Stratigraphy, Fractures, Oriented Core, Geophysical Logs

KEY DATA: Geologic Units, Fracture Inclination, Fracture Strike, Fracture Frequency

COMMENTS:

SUMMARY:
Core hole USW G-4 was cored from 13m to 915m at a location approx. 91m southwest of the proposed site of the exploratory shaft. Welding characteristics of ash-flow tuff members and within the tuffaceous beds of Calico Hills vary in thickness from 0.8m to 17.0m. Zeolitic alteration of rock units occurs below a depth of 434.2m. Above this depth, densely welded units are dominantly devitrified, and non- to moderately welded tuff units are dominantly vitric. Three obvious lithophysae-bearing intervals occur in the densely welded zone of the Topopah Spring Member. The most conspicuous zone occurs between depths of 143m and 207m, and commonly contains from 11 to 29 percent voids. 81 percent of the fractures identified in core occur in the densely welded zones of the Tiva Canyon and Topopah Spring Members. Fracturing decreases significantly below the densely welded zone of the Topopah Spring. Strike directions of fractures identified from downhole television camera observations in the Tiva Canyon Member suggest an absence of any preferred orientation. In the densely welded zone of the Topopah Spring Member and the upper part of the tuffaceous beds of Calico Hills most fractures strike between N30W and N60E.

NRC DOCUMENT DATA BASE

WWL Document Number: 178 Document Summary

TITLE: Preliminary Geologic Map of Yucca Mountain Nye County, Nevada With Geologic Sections

AUTHOR: Scott, R. B. and Bonk, J.

Document Number: USGS-OFR-84-494 Publication Date: 1984
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Dec,1985

Document Rating (1=poor to 10=excellent): 7
Document Description (general, specific, etc.): General
Document Read By (Initials): TLS

KEY WORDS: Description of Map Units

KEY DATA: Description of Map Units, Geologic Sections

COMMENTS:

SUMMARY:
The report consists of a description of map units and two large sheets: Sheet 1 is a preliminary geologic map of Yucca Mountain with geologic sections, Sheet 2 has geologic sections. The cross sections emphasize lithologic and stratigraphic features important to hydrology.

NRC DOCUMENT DATA BASE

WWL Document Number: 181

Document Summary

TITLE: Evaluation of Tuff as a Waste Isolation Medium

AUTHOR: Tyler, L. D.

Document Number: AT(29-1)789
Requested From: NRC
Received From: NRC

Publication Date: ?
Request Date: Oct. 85
Receipt Date: Dec,1985

Document Rating (1=poor to 10=excellent): 6
Document Description (general, specific, etc.): Overview
Document Read By (Initials): TLS

KEY WORDS: Geology

KEY DATA: Sorption Ratios, Physical Properties

COMMENTS:

SUMMARY:
The properties of the rock are discussed and compared with other isolation media. The favorable and unfavorable aspects are presented. Also, unresolved issues are discussed along with the investigative program for addressing these issues. Tuff is of interest for use as an isolation medium for high heat producing wastes because it provides highly sorptive minerals and suitable thermomechanical properties.

NRC DOCUMENT DATA BASE

WWL Document Number: 198 Document Summary

TITLE: Repository Site Data Report for Unsaturated Tuff, Yucca Mountain, Nevada

AUTHOR: Tien, P. L., Siegel, M. D., Updegraff, C. D., Wahi, K. K., and Guzowski, R. V.

Document Number: SAND84-2668 Publication Date: Nov,1985
Requested From: NRC Request Date: Oct. 85
Received From: NRC Receipt Date: Dec,1985

Document Rating (1=poor to 10=excellent): 8
Document Description (general, specific, etc.): Overview
Document Read By (Initials): TLS

KEY WORDS: Regional Setting, Stratigraphy, Petrology, Mineralogy, Geologic Structure, Geochemistry, Ground Water Hydrology, Thermomechanical Properties, Recommendations for Future Work

KEY DATA: Sorption Data, Stratigraphic Descriptions, Lithologic Descriptions,

Porosity, Saturation, Fracture Densities, Effective Porosity, Relative Permeability, Fracture Hydraulic Conductivity, Hydraulic Conductivity

COMMENTS:

SUMMARY:
Geochemical, hydrologic and thermomechancial data available on the unsaturated tuffs of Yucca MOuntain are tabulated in this report. Where the data are very sparse, they have been supplemented by data from the saturated zone or from areas other than Yucca Mountain. The report is divided into nine major sections: (1) Regional Setting, (2) Stratigraphy, (3) Petrology and Mineralogy, (4) Geologic Structures, (5) Geochemistry, (6) Ground Water Hydrology, (7) Thermomechanical Properties, (8) Recommendations for Future Work, (9) Data. Specific recommendations for future work which pertain to hydrology are: (1) Collection of in-situ pressure head data for air and liquid phases. (2) Obtain data for relative air and liquid hydraulic conductivities vs. pressure head. (3) Collection of degree of saturation vs. pressure head data. (4) Determination of how much recharge enters the unsaturated zone by way of fractures and how much enters by way of pore space. (5) Determination of the fracture network in the tuffs and the possibility that fracture flow may dominate pore flow in the unsaturated zone. Other recommendations are: Detailed correlation from hole to hole of the subsurface distributions of the tuff units is impossible. More subsurface data are needed to adequately model the site.

ATTACHMENT C

NEVADA NUCLEAR WASTE STORAGE INVESTIGATION
HYDROGEOLOGY DATA BASE
WATER, WASTE & LAND, INC.
DATA BASE

July 30, 1986

Well #	Formation	Core test or Well test	Porosity	Permeability (saturated) m/s	Storage Coef.	Depth meters	Depth (Second) meters	WWL #	page num.
USW-G4	TCw	C	0.08	9.70E-12		13.1		56	23
USW-G4	PTn	C	0.27	2.60E-11		37.8		56	23
USW-G4	PTn	C	0.65	2.40E-06		63.4		56	23
USW-G4	TSw	C	0.03	8.60E-13		75.3		56	23
USW-G4	TSw	C	0.09	2.20E-11		263.3		56	23
USW-G4	TSw	C	0.16	3.90E-11		263.3		56	23
USW-G4	TSw	C	0.11	1.90E-11		353.0		56	23
USW-G4	TSw	C	0.11	9.20E-12		370.3		56	23
USW-G4	TSw	C	0.10	1.30E-11		382.8		56	23
USW-G4	TSw	C	0.06	1.50E-11		389.5		56	23
USW-G4	TSw	C	0.09	4.50E-10		395.9		56	23
USW-G4	TSw	C	0.04	3.00E-12		403.6		56	23
USW-G4	CHnv	C	0.21	8.00E-11		414.2		56	23
USW-G4	CHnz	C	0.41	3.00E-12		428.2		56	23
USW-G4	CHnz	C	0.28	2.00E-11		471.8		56	23
USW-G4	CHnz	C	0.33	5.10E-11		472.7		56	23
USW-G4	Chnz	C	0.30	4.24E-12		513.9		56	23
USW-G4	CHnz	C	0.22	2.50E-11		526.7		56	24
USW-G4	CHnz	C	0.24	2.50E-11		529.4		56	24
USW-G4	CHnz	C	0.26	2.30E-12		539.2		56	24
USW-G4	CHnz	C	0.25	6.50E-12		541.9		56	24
USW-G4	CHnz	C	0.28	2.30E-11		541.9		56	24
USW-G4	CHnz	C	0.28	1.60E-10		544.7		56	24
USW-G4	PPw	C	0.24	1.40E-08		578.8		56	24
USW-G4	CFn	C	0.29	2.00E-11		611.4		56	24
USW-G4	CFn	C	0.19	4.40E-10		640.4		56	24
USW-G4	BFw	C	0.24	2.30E-09		731.8		56	24
USW-G4	BFw	C	0.27	6.30E-09		733.7		56	24
USW-H1	PPw	W Drawdown		1.67E-05	5.00E-01	572.0	688.0	66	22
USW-H1	PPw	W Recovery		3.30E-05	3.00E-01	572.0	688.0	66	22
USW-H1	PPw +	W Injection		3.50E-07	2.90E-05	687.0	697.0	66	22
USW-H1	PPw +	W Drawdown		5.00E-08	2.00E-04	687.0	1829.0	66	22
USW-H1	PPw +	W Recovery		1.50E-07	1.00E-05	687.0	1829.0	66	22
USW-H1	PPw +	W Recovery		1.67E-07	5.00E-07	687.0	1829.0	66	22

Well #	Formation	Core test or Well test	Porosity	Permeability (saturated) m/s	Storage Coef.	Depth meters	Depth (Second) meters	WWL #	page num.
USW-H1	BFw +	W Injection		4.06E-10	2.90E-05	811.0	1829.0	66	22
USW-H1	Tram	W Injection		1.35E-10	2.90E-04	926.0	1829.0	66	22
USW-H1	Older	W Injection		1.17E-09	5.90E-05	1200.0	1829.0	66	22
USW-H1	Older	W Injection		1.76E-10	5.90E-05	1407.0	1829.0	66	22
USW-H1	Older	W Injection		1.17E-10	2.90E-05	1621.0	1829.0	66	22
USW-H3	Tram +	W Pumping		1.25E-08		754.0	1219.0	17	13
USW-H3	Tram +	W Pumping		9.95E-09		754.0	1219.0	17	13
USW-H3	Tram +	W Pumping		2.92E-08		822.0	1219.0	17	13
USW-H3	Tram	W Injection		3.50E-08	4.00E-06	792.0	850.0	17	13
USW-H3	Tram	W Injection		3.51E-09		851.0	917.0	17	13
USW-H3	Tram	W Injection		5.69E-09		911.0	972.0	17	13
USW-H3	Tram	W Injection		1.14E-08	6.00E-06	911.0	972.0	17	13
USW-H3	Tram +	W Injection		4.69E-09	7.00E-06	972.0	1219.0	17	13
USW-H3	Tram +	W Injection		1.40E-09		972.0	1219.0	17	13
USW-H3	Tram +	W Injection		5.69E-09		1063.0	1124.0	17	13
USW-H3	Tram +	W Injection		1.90E-08	7.00E-06	1063.0	1124.0	17	13
USW-H3	LR	W Injection		1.25E-09		1126.0	1219.0	17	13
USW-H3	Tram +	W Swabbing		2.99E-08		792.0	1219.0	17	13
USW-H3	Tram +	W Swabbing		1.90E-08		1063.0	1124.0	17	13
J-13	TSw	W Pumping		1.16E-05		303.6	422.5	87	23
J-13	CHn	W Injection		1.74E-06		471.2	502.0	87	23
J-13	CHn	W Swabbing		1.09E-06		471.2	502.0	87	23
J-13	CHn	W Swabbing		1.50E-06		471.2	502.0	87	23
J-13	CHn +	W Injection		1.50E-07		501.1	562.1	87	23
J-13	CHn +	W Swabbing		3.01E-07		501.1	562.1	87	23
J-13	CHn +	W Injection		6.60E-08		505.4	565.7	87	23
J-13	CHn +	W Swabbing		7.18E-08		505.4	565.7	87	23
J-13	CHn +	W Swabbing		1.50E-07		471.2	612.6	87	23
J-13	CHn +	W Swabbing		1.10E-07		471.2	661.4	87	24
J-13	PP +	W Injection		1.04E-07		584.6	645.6	87	24
J-13	BF	W Injection		3.36E-08		639.8	670.3	87	24
J-13	BF	W Injection		1.85E-07		668.7	669.2	87	24
J-13	BF +	W Injection		3.82E-08		719.3	749.8	87	24
J-13	Tram	W Swabbing		6.48E-08		772.7	803.1	87	24

Well #	Formation	Core test or Well test	Porosity	Permeability (saturated) m/s	Storage Coef.	Depth meters	Depth (Second) meters	WWL #	page num.
J-13	CHn +	W Swabbing		1.02E-07		471.2	912.9	87	24
J-13	Tram +	W Swabbing		3.01E-08		819.9	1063.1	87	24
USW H-1	PTn	C	0.45			33.5		16	8
USW H-1	TSw	C	0.22			128.0		16	8
USW H-1	TSw	C	0.23			129.1		16	8
USW H-1	TSw	C	0.21			134.9		16	8
USW H-1	TSw	C	0.19			136.6		16	8
USW H-1	TSw	C	0.17			142.5		16	8
USW H-1	TSw	C	0.15			143.3		16	8
USW H-1	TSw	C	0.17			219.2		16	8
USW H-1	TSw	C	0.28			221.4		16	8
USW H-1	TSw	C	0.18			222.1		16	8
USW H-1	TSw	C	0.16			390.4		16	8
USW H-1	TSw	C	0.16			390.6		16	8
USW H-1	TSw	C	0.14			397.9		16	8
USW H-1	TSw	C	0.10			398.7		16	8
UE-25b#1	TSw	C	0.12	9.61E-12		225.7		13	13
UE-25b#1	CHn	C	0.25	1.97E-09		479.3		13	13
UE-25b#1	PP	C	0.24	7.64E-10		625.8		13	13
UE-25b#1	PP	C	0.10	9.61E-12		679.5		13	13
UE-25b#1	BF	C	0.23	7.64E-09		752.7		13	13
UE-25b#1	BF	C	0.21	7.64E-10		788.9		13	13
UE-25b#1	BF	C	0.22	5.79E-10		814.1		13	13
UE-25b#1	BF	C	0.23	9.61E-11		843.5		13	13
UE-25b#1	Tram	C	0.19	3.24E-10		923.9		13	13
UE-25b#1	Tram	C	0.19	2.08E-10		948.8		13	13
UE-25b#1	Tram	C	0.15	3.36E-09		1141.4		13	13
UE-25b#1	Tram	C	0.13	3.24E-09		1171.0		13	13
UE-25b#1	Tram	C	0.11	1.27E-09		1201.8		13	13
UE-25b#1		W Injection		4.98E-07		514.0	579.0	13	20
UE-25b#1		W Injection		5.21E-07		505.0	579.0	13	20
UE-25b#1		W Injection		4.05E-07		477.0	579.0	13	20
UE-25b#1		W Injection		4.05E-07		491.0	505.0	13	20
UE-25b#1		W Injection		1.39E-06		477.0	491.0	13	20

Attachment C
July 30, 1986

NNWSI Data
WWL #4001

Well #	Formation	Core test or Well test	Porosity	Permeability (saturated) m/s	Storage Coef.	Depth meters	Depth (Second) meters	WWL #	page num.
UE-25b#1		W Injection		1.13E-09		1006.0	1220.0	13	20
UE-25b#1		W Injection		1.27E-06		792.0	1220.0	13	20
UE-25b#1		W Injection		3.82E-06		820.0	860.0	13	20
UE-25b#1		W Injection		1.15E-05		779.0	819.0	13	20
UE-25b#1		W Injection		2.89E-08		743.0	783.0	13	20
UE-25b#1		W Injection		5.32E-08		703.0	743.0	13	20
UE-25b#1		W Injection		1.06E-05		581.0	621.0	13	20
UE-25b#1		W Injection		4.05E-07		504.0	544.0	13	20
UE-25b#1		W Injection		6.13E-07		621.0	661.0	13	20
UE-25b#1		W Pumping		5.21E-06		471.0	1220.0	13	20
USW H-1	PP	C	0.28	1.16E-09		640.0		26	10
USW H-1	PP	C	0.29	8.10E-10		641.0		26	10
USW H-1	PP	C	0.29	6.94E-10		641.0		26	10
USW H-1	BF	C	0.27	3.47E-10		709.0		26	10
USW H-1	BF	C	0.32	3.47E-09		709.0		26	10
USW H-1	BF	C	0.34	9.26E-09		710.0		26	10
USW H-1	BF	C	0.20	1.16E-09		713.0		26	10
USW H-1	BF	C	0.28	1.16E-08		764.0		26	10
USW H-1	BF	C	0.25	6.94E-09		772.0		26	10
USW H-1	BF	C	0.19	4.63E-10		790.0		26	10
USW H-1	BF	C	0.20	6.94E-10		791.0		26	10
USW H-1	BF	C	0.22	8.10E-10		792.0		26	10
USW H-1	BF	C	0.25	4.63E-10		830.0		26	10
USW H-1	Tram	C	0.26	1.16E-09		833.0		26	10
USW H-1	Tram	C	0.26	2.31E-10		840.0		26	10
USW H-1	Tram	C	0.21	4.63E-11		844.0		26	10
USW H-1	Tram	C	0.21	4.63E-09		1031.0		26	10
USW H-1	Tram	C	0.23	3.47E-09		1031.0		26	10
USW H-1	Tram	C	0.22	2.31E-09		1032.0		26	10
USW H-1	Tram	C	0.18	1.16E-09		1039.0		26	10
USW H-1	Tram	C	0.18	2.31E-09		1039.0		26	10
USW H-1	Tram	C	0.21	5.79E-10		1040.0		26	10
USW H-1	FB	C	0.07	9.26E-12		1201.0		26	10
USW H-1	Older +	C	0.17	6.94E-10		1569.0		26	10

Well #	Formation	Core test or Well test	Porosity	Permeability (saturated) m/s	Storage Coef.	Depth meters	Depth (Second) meters	WWL #	page num.
USW H-1	Older +	C	0.09	3.47E-09		1820.0		26	10
USW H-1	PP	W		3.00E+00		572.0	597.0	26	40
USW H-1	PP	W		1.00E+00		597.0	616.0	26	40
USW H-1	PP	W		1.00E+00		616.0	652.0	26	40
USW H-1	PP	W		1.80E+01		652.0	653.0	26	40
USW H-1	PP	W		4.00E-02		653.0	688.0	26	40
USW H-1	PP	W		2.00E-02		687.0	694.0	26	40
USW H-1	PP +	W		2.00E-04		694.0	736.0	26	40
USW H-1	BF	W		1.00E-01		736.0	741.0	26	40
USW H-1	BF	W		1.00E-02		741.0	758.0	26	40
USW H-1	BF	W		3.00E-04		758.0	792.0	26	40
USW H-1	BF +	W		1.00E-05		792.0	1829.0	26	40
UE25a-1		C	0.06	0.186		17.7		99	23
UE25a-1		C	0.07			31.1		99	23
UE25a-1		C	0.06			46.7		99	23
UE25a-1		C	0.23			57.0		99	23
UE25a-1		C	0.30			61.6		99	23
UE25a-1		C	0.53			64.6		99	23
UE25a-1		C	0.53			71.3		99	23
UE25a-1		C	0.52			80.2		99	23
UE25a-1		C	0.27			83.2		99	23
UE25a-1		C	0.22			100.0		99	23
UE25a-1		C	0.13			109.8		99	23
UE25a-1		C	0.15			128.4		99	23
UE25a-1		C	0.19			143.6		99	23
UE25a-1		C	0.18			159.8		99	23
UE25a-1		C	0.18			173.5		99	23
UE25a-1		C	0.18			189.9		99	23
UE25a-1		C	0.08			201.2		99	23
UE25a-1		C	0.11			223.5		99	23
UE25a-1		C	0.13			235.4		99	23
UE25a-1		C	0.10			248.8		99	23
UE25a-1		C	0.09			264.0		99	23
UE25a-1		C	0.10			280.8		99	23

Well #	Formation	Core test or Well test	Porosity	Permeability (saturated) m/s	Storage Coef.	Depth meters	Depth (Second) meters	WWL #	page num.
UE25a-1		C	0.12			307.9		99	23
UE25a-1		C	0.11			317.1		99	23
UE25a-1		C	0.09			339.0		99	23
UE25a-1		C	0.09			360.7		99	23
UE25a-1		C	0.08			380.8		99	23
UE25a-1		C	0.13			386.0		99	23