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

February 28, 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 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

Water, Waste and Land, Inc. (WWL) is a subcontractor for Nuclear Waste Consultants (NWC) which is a prime contractor for NRC Project RS-MNS-85-009 entitled "Technical Assistance in Hydrology - Project B - Analysis." The group at WWL is responsible for review of hydrogeologic investigations of the Nevada Nuclear Waste Storage Investigations Project (NNWSI). As part of the contract, Subtask 1.2, Data Inventory and Management, requires submission of a letter report to the NRC outlining the status of the Data Inventory and Compiled Database.

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DATA BASE DESCRIPTION

All of the data which has been made available to WWL is in the form of draft or final reports and published papers. Some of these documents contain analyses and interpretations as well as raw data while others contain only interpretations and generalizations based on data contained in other reports. Based on these considerations, the overall database has been divided into two components:

1) Data Inventory
2) Summarized Data

Each of the above components is described in the following paragraphs.

Data Inventory

The data inventory lists in summary form the type and amount of information which are available and documented. A computerized database is utilized for the management of the library of available information. The database contains pertinent bibliographic information (title, author, date, document number). As each document is reviewed, additional information is added to the database (key words, key data, general comments, and summary). This type of data structure allows for rapid search and retrieval of information pertinent to the hydrogeology of the Yucca Mountain Site.

Summarized Data

The compiled database must be summarized using a format suitable for:

1. reviewing the appropriate hydrogeologic and related data;
2. developing three-dimensional relationships and governing processes;
3. developing conceptual model(s) of ground water flow and radionuclide transport pathways; and,

4. evaluating conceptual models numerically.

In addition, the format should allow the database to be updated periodically to include new or additional information. It is emphasized that most of the information contained in the database is data collected by DOE or their contractors as part of the NNWSI site investigations.

The format chosen for the presentation of the summarized data is 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. Because it is easy to present both quantitative and qualitative information, the well charts can be used to present large amounts of data in a cohesive form. As new information becomes available, it will be quite easy to update and add to the existing data.

DATA MANAGEMENT APPROACH

Data Inventory

As documents pertinent to the hydrogeology of Yucca Mountain are received, the bibliographic information is added to the computerized database. A sequential number is assigned to the document and the document is filed according to that number. As the documents are read and reviewed, the additional summary data is added to the data base. This approach allows rapid retrieval of any document based on any one of several criteria (document number, title, author, etc.) and also allows rapid identification of documents which have been reviewed by the WWL staff.

Summarized Data

Since a large amount of information about the unsaturated zone will be obtained at the exploratory shaft, it is important to be able to determine the degree of heterogeneity which exists in the varying units of the unsaturated zone. The approach taken to perform this task is to compile the data from test wells at continually increasing distance from the shaft location. This approach will allow rapid evaluation of published information from the shaft by comparing it to the compiled data. In addition, systematic evaluation of the three-dimensional distribution of geohydraulic properties at Yucca Mountain is possible with this approach.

Since the proposed repository horizon is to be located in the thick unsaturated section of Yucca Mountain, locating and reviewing data characterizing these unsaturated regions is deemed to be of primary importance. Because of this and the fact that an exploratory shaft is being constructed through this zone at Yucca Mountain, the well charts are being developed in the following sequence:

1. All pertinent data for wells located near the proposed exploratory shaft.
2. All data for other wells located within the potential repository block.
3. Data for test wells located outside the potential repository block.
4. Data for other wells in the vicinity.

DATA BASE STATUS

Data Inventory

The bibliographic information for 203 documents have currently been entered into the computerized database. A complete bibliography of these

documents is provided in Attachment A. We have compared the list of documents currently on hand with a list of documents maintained by the project officer. We have identified the documents listed in Table 1 that are contained in our data base but which were not on the project officer's list. A list of documents which we do not have but which appear on the project officer's list is presented in Table 2. Finally, we have reviewed the list of documents which have formal reviews available. We have copies of all of the formal reviews for the documents as listed by the project officer.

At the present time, we have informally reviewed 24 documents. Informal summaries of these documents are presented in Attachment B. Based on information provided by the project officer, we will continue to add summaries to the database in the order which reflects the priorities provided on his list of documents.

Summarized Data

Using the approach outlined in the previous section, summary well charts have been initiated for three wells and the sequence in which additional charts will be prepared has been developed. Locations of the drill holes and the approximate boundary of the repository block are shown on Figure 1. For summarization of the well data, wells have been grouped as follows:

Group I: USW G-4, USW H-5, USW H-4, and UE25a-6
Group II: USW G-1, USW H-1, USW H-3, and USW G-3
Group III: UE25a-1, UE25b-1H, UE25b2-H, UE25a-4, UE25a-5, and UE25a-7
Group IV: all remaining wells

Well charts will be prepared for wells beginning with wells in Group I and ending with wells in Group IV. The Group I wells are in the exploratory block and are near the proposed exploratory shaft. Two east-west cross-sections can be developed from the summarized data from Group I wells. Cross-section Ia can

be prepared with wells USW H-5, USW G-4 and UE25a-6 while cross-section Ib can be prepared with wells USW H-5 and USW H-4. In a similar manner, a north-south cross-section can be prepared with the four Group II wells. The Group III wells lie outside (primarily to the north and east) of the proposed exploratory block. Preparation of well charts for these wells will, therefore, be delayed until those within the primary block have be prepared. The Group IV wells have locations surrounding the exploratory block at a range of distances. At the present time summaries have been completed for the following Group I wells:

USW G-4
USW H-5
USW H-4

Copies of the well charts for these wells are provided in Attachment C.

Test well USW G-4 is located approximately 300 feet southwest of the exploratory shaft. The exploratory shaft will be used for in-situ studies of the geotechnical, geologic, and hydrologic characteristics of rock in the unsaturated zone. The test well has provided information on the similarity of geologic conditions between it and nearby boreholes and for use in the design and construction phases of the exploratory shaft. A predicted log of the stratigraphy of the USW G-4 site was made prior to the drilling of the hole based on subsurface data from holes USW G-1 and UE-25a#1. A comparison of predicted and actual thicknesses and depths indicated difficulties in predicting precise thicknesses of the stratigraphic units. Analysis of the core taken form the Topopah Spring Member showed that thinning and pinching out of the lithophysal zones occurs from well to well.

Test well USW H-4 was completed in April, 1982. After a depth of 564 meters was reached, geophysical logs were run and sidewall sampling was attempted. Only limited success was achieved in the sidewall sampling. The

hole was then cased to 561 meters and drilled to a total depth of 1219 meters. Hydrologic tests were conducted, primarily in the uncased portion of the hole. The casing is perforated in the interval from 533 to 539 meters. The amount of physical data obtained for USW H-4 is apparently significantly less than is available for USW G-4.

Test well USW H-5 was also drilled to a total depth of 1219 meters. As with USW H-4, conventional core samples were not collected during drilling operations. Seven sidewall core samples were obtained but were not of suitable quality to allow determination of hydrologic properties. Again, the amount of data available for USW H-5 is significantly less than is available for USW G-4.

SUMMARY

In summary, we have established data management techniques which will allow not only the WWL team to efficiently review data relative to the NNWSI Project but will also allow others (NWC personnel, new NRC staff, etc.) to be brought up to speed rapidly, if necessary. Because of the large amount of literature available relative to the Yucca Mountain Site, a method has been developed to allow the staff to keep up to date with respect to project reports, articles, and publications. The well charts allow the hydrogeologic data to be presented in a framework that is easy to understand and will allow the database to be quickly updated. It is anticipated that this information will be very valuable in evaluating the conceptual hydrogeologic model (subtask 1.4).

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
Project Manager

Attachments as noted

LAD:

Table 1.

Documents in WWL Database
Which Are Not on NRC List

Ann Arbor Science Publishers, Scott, R. B., Spengler, R. W., Diehl, S., Lappin, A. R., and Chornack, M., Geologic Character of Tuffs in the Unsaturated Zone at Yucca Mountain, Southern Nevada, 1983, WWL#: 97

CONF-791016, Gardiner, D. A., and Truett, T., Proceedings of the 1979 DOE Statistical Symposium, Sep,1980, WWL#: 77

DOE/RW-0012, DOE Office of Civilian Radioactive Waste Management, Draft Environmental Assessment Yucca Mountain Site, Nevada Research and Development Area, Nevada, Dec,1984, WWL#: 76

LBL-18473, Wang, J.S.Y. and Narasimhan T.N., Hydrologic Mechanisms Governing Fluid Flow in Partially Saturated, Fractured, Porous Tuff at Yucca Mountain, Oct. 1984, WWL#: 1

MRSSP-v.26, McVay, G. L., Scientific Basis for Nuclear Waste Management VII Symposium held November 1983 in Boston, Massachusetts, U.S.A., 1984, WWL#: 94

NRC-04-81-224, Kilbury, R. K., Water Intake at the Atmosphere-Earth Interface in a Fractured Rock System, Nov,1984, WWL#: 84

NUREG/CR-2782, Thomas, S. D., Ross, B., and Mercer, J. W., A Summary of Repository Siting Models, July,1982, WWL#: 78

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SAND81-7210, Klasi, M. L., Russell, J. E., and McClain, W. C., Far-Field Thermal Analysis of a High Level Waste Repository in Tuff, July,1982, WWL#: 63

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SAND83-0757, Mondy, L. A., Wilson, R. K., and Bixler, N. E., Comparison of Waste Emplacement Configurations for a Nuclear Waste Repository in Tuff IV. Thermo-Hydrological Analysis, Aug,1983, WWL#: 62

SAND84-0996, Hayden, N. K., Benchmarking NNWSI Flow and Transport Codes: Cove 1 Results, June,1985, WWL#: 58

SAND84-1643, Langkopf, B. S., Satter, B. J., and Welch, E. P. , Version 1 of the Users Manual for the Tuff Data Base Interface, April,1985, WWL#: 59

UCID-20289, Ramirez, A. L., and Daily, W. D., Preliminary Evaluation of Alterant Geophysical Tomography in Welded Tuff, Dec,1984, WWL#: 40

Table 2.

Documents in NRC Database
Which Are Not in WWL Database

NNWSI NVO Peer Rev., Peer Review August 24, 28, 1981, No NRC Log Number.

NVO-196-23, Radionuclide Migration in Tuff and Granite Peer Review Documentation, NRC Log Number 00283.

SAND81-1768, Conceptual Design of Field Experiments for Welded Tuff Rock-Mechanics Program, NRC Log Number 00942.

SAND82-2212, Bibliography with Abstracts of Geological Lieterature Pertaining to Southern Nevada with Particular Reference to the NTS, NRC Log Number 01332.

SAND82-2441, Empirically Determined Uncertainty in Potassium Argon Ages for Pilo-Pliestocente Basalts from Crater Flat, Nye County, Nevada, NRC Log Number 01278.

SAND83-1778, Repository Sealing Concepts for the Nevada Nuclear Waste Storage Inverstigations Project, NRC Log Number 01568.

USGS OFR 81-0615, Interpretation of Geophysical Well-Log Measurements in Drill Holes UE25a-4, -5, -6, and -7, Yucca Mountain, Nevada Test Site, NRC Log Number 00306.

USGS OFR 82-0765, Mineralogy of Fine Grained Alluvium from Borehole U11G, EXPL. 1, Northern Frenchmean Flat, Nevada Test Site, NRC Log Number 00972.

USGS WRI 83-4067, Water Table in Rocks of Cenozoic and Paleozoic Age, 1980, Yucca Flat, Nevada Test Site, Nevada, NRC Log Number 01484.

ATTACHMENT A

NEVADA NUCLEAR WASTE STORAGE INVESTIGATION

HYDROGEOLOGY BIBLIOGRAPHY

WATER, WASTE AND LAND, INC.

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9. DOE/RW-0012, DOE Office of Civilian Radioactive Waste Management, Draft Environmental Assessment Yucca Mountain Site, Nevada Research and Development Area, Nevada, Dec,1984, WWL#: 76

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12. LA-09174-PR, Blacic, J., Carter, J., Halleck, P., Johnson, P., Shankland, T., andersen, R., Spicochi, K., and Heller, A., Effects of Long-Term Exposure of Tuffs to High-Level Nuclear Waste Repository Conditions: Preliminary Report, ?, WWL#: 102

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14. LA-10003-MS, Warren, R. G., Byers, F. M., Jr., and Caporuscio, F. A., Petrography and Mineral Chemistry of Units of the Topopah Spring, Calico Hills and Crater Flat Tuffs, and Older Volcanic Units, with Emphasis on Samples from Drill Hole USW G-1, Yucca Mountain, Nevada Test Site, June,1984, WWL#: 54

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16. LA-10177-M, Lane, L. J., Surface Water Management: A User's Guide to Calculate a Water Balance Using the CREAMS Model, Nov,1984, WWL#: 144

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36. LA-UR-84-332, Bish, D. L., Ogard, A. E., and Vaniman, D. T., Mineralogy-Petrology and Groundwater Geochemistry of Yucca Mountain Tuffs, 1984, WWL#: 101

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38. LASL, Rundberg, R. S., Thompson, J. L., and Maestas, S., Radionuclide Migration: Laboratory Experiments With Isolated Fractures, Nov,1981, WWL#: 164

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ATTACHMENT B

NEVADA NUCLEAR WASTE STORAGE INVESTIGATION

HYDROGEOLOGY DOCUMENT SUMMARY SHEETS

WATER, WASTE AND LAND, INC.

DATA BASE

February 28, 1986

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
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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.):
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: 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,rock
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 characteristic 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 characteristic 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, Data
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: 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 avg. horiz. 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:
The report presents data on drilling operations, lithology, borehole geophysics, hydrologic monitoring, water chemistry, pumping tests, and packer-injection tests. 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: 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:
This 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 3,000 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 waters.

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 Publication Date: May,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: Minerals, Devitrified, Zeolitized, Fracture, Static Water Level

KEY DATA: Mineral Analysis

COMMENTS:

SUMMARY:
The mineralogy of fractures in USW G-4, from a depth of nearly 244 meters to the static water level (SWL) at 541 meters, 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: 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 Publication Date: Aug,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: 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 Publication Date: May,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: 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 an 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): DBM, LAD, TLS

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: 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): DBM, LAD, 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 Nevada Test Site and of the southern Nevada region. Potential geohydrological impacts which have been pointed out by the DOE including 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: 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 7 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: 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 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): 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: 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 an 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 divitrified, 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 tufaceous 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 - Preliminary geologic map of Yucca Mountain with geologic sections.
Sheet 2 - Geologic sections.

The cross sections emphasize lithologic and stratigraphic features important to hydrology.

ATTACHMENT C

NEVADA NUCLEAR WASTE STORAGE INVESTIGATION

SUMMARY WELL CHARTS

WATER, WASTE AND LAND, INC.

DATA BASE

February 28, 1986

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., Wahl, 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 thermomechanical 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.

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