**UNDERGROUND TEST AREA PROJECT
PHASE I DATA ANALYSIS TASK**

VOLUME V

**TRANSPORT PARAMETER AND SOURCE TERM
DATA DOCUMENTATION PACKAGE**

Prepared for

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Preface

This product represents the documentation for the Phase I Data Analysis Task performed in support of the current Regional Flow Model, Transport Model, and Risk Assessment for the Nevada Test Site Underground Test Area Subproject. Because of the size and complexity of the model area, a considerable quantity of data were collected and analyzed in support of the modeling efforts. The data analysis task was broken into eight subtasks, and descriptions of the subtask activities are contained in the following eight volumes that comprise the Phase I Data Analysis Documentation.

- Volume I: Geologic Model Documentation Package
- Volume II: Potentiometric Data Documentation Package
- Volume III: Groundwater Recharge and Discharge Data Documentation Package
- Volume IV: Hydrologic Parameter Data Documentation Package
- Volume V: Transport Parameter and Source Term Data Documentation Package
- Volume VI: Groundwater Flow Model Documentation Package
- Volume VII: Tritium Transport Model Documentation Package
- Volume VIII: Risk Assessment Documentation Package

Each of the volumes details the results of one or two related subtasks. A summary review of project data and results will be contained in the Phase I Report (in progress).

The Underground Test Area Subproject Phase I Data Analysis Task was led by IT Corporation (IT); Tetra Tech, Inc.; GeoTrans, Inc.; and Daniel B. Stephens Corporation. The task could not have been completed without the cooperative efforts of many other participants involved in work at the Nevada Test Site. Their organizations are listed in alphabetical order:

- Bechtel Nevada
- Desert Research Institute
- Lawrence Livermore National Laboratory
- Los Alamos National Laboratory
- Raytheon Services Nevada
- U.S. Geological Survey - Geologic Division
- U.S. Geological Survey - Water Resources Division
- U.S. Geological Survey - Yucca Mountain Project

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List of Abbreviations and Acronyms

AA	Alluvial aquifer
BAQ	Basal Aquifer
BCU	Basal Confining Unit
CAU	Corrective Action Unit(s)
cm ² /sec	Square centimeter(s) per second
DIF	Data Information Form
DQD_F	Data Quality Documentation Flag
DRI	Desert Research Institute
DVS	Death Valley sediments
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
ERDBMS	Environmental Restoration Data Base Management System
ERP	(Nevada) Environmental Restoration Program
ft	Foot (feet)
ft ³	Cubic foot (feet)
ft ³ /min	Cubic feet per minute
gpm	Gallon(s) per minute
HRMP	Hydrology/Radionuclide Migration Project
HSU	Hydrostratigraphic unit
IT	IT Corporation
LANL	Los Alamos National Laboratories
LCA	Lower Carbonate Aquifer
LCCU	Lower Clastic Confining Unit
LLNL	Lawrence Livermore National Laboratories
m	Meter(s)
m ² /day	Square meter(s) per day
m ³	Cubic meter(s)
m ³ /min	Cubic meter(s) per minute
NA	Not applicable
NTS	Nevada Test Site
NWIS	National Water Information System
pCi/L	PicoCurie(s) per Liter
SOP	Standard Operating Procedure

List of Abbreviations and Acronyms (Continued)

SQP	Standard Quality Practice
TBAQ & TMA	Timber Mountain Aquifer
TC	Tuff Cone
TCBCU	Bullfrog Confining Unit
TCU	Tuff Confining Unit
TCTC	Calico Hills Tuff Cone
TPTA	Topopah Springs Tuff Aquifer
TPTC	Paintbrush Group Tuff Cone
TS	Tertiary sediments
UCCU	Upper Clastic Confining Unit
UGTA	Underground Test Area
USGS	U.S. Geological Survey
VCCU	Volcaniclastic confining unit
VCU	Volcanic Confining Unit
VU	Volcanics undifferentiated
VTA	Vitric Tuff Aquifer
WLA	Wahmonie Lavas Aquifer
WTA	Welded Tuff Aquifer
μCi/mL	MicroCurie(s) per milliliter

1.0 Introduction

The Nevada Test Site (NTS), located in Nye County in southern Nevada, was the location of 908 nuclear detonations conducted in shafts and tunnels between 1951 and 1992. About one-third of these nuclear underground detonations were conducted near or below the water table (Duncan, 1993). As an unavoidable consequence of these testing activities, radionuclides have been introduced into the subsurface environment, impacting groundwater. The U.S. Department of Energy, Nevada Operations Office (DOE/NV) has been in the process of investigating the effects of these underground nuclear detonations as part of the Underground Test Area (UGTA) Subproject. Descriptions of the project, the data analysis task, and the Risk Assessment Subtask are briefly discussed.

1.1 Subproject Description

This subsection includes descriptions of the purpose, scope, objectives, strategy, and organization of the UGTA Subproject. The documentation that supports this effort is outlined in Section 1.2.5 of this report.

1.1.1 Subproject Purpose and Scope

The purpose of the subproject is to collect data and perform technical evaluations to support decisions about the corrective actions necessary to ensure that the weapons testing areas do not pose a significant risk to human health and the environment.

The scope of the UGTA Subproject includes the following activities:

- New and existing data collection and evaluation
- Quantification of risk to human health and the environment
- Selection of the corrective actions to reduce risk from the sites
- Implementation of corrective actions and closure of the testing areas

1.1.2 Subproject Objectives

The UGTA Subproject objectives are prerequisites to generating the necessary end products to complete the subproject. The objectives provide the framework for subproject strategy. The subproject definition establishes the starting point, and the objectives focus on the end products.

The overall objective of the UGTA Subproject is to evaluate the effects of the weapons testing areas on groundwater and to identify and implement the appropriate corrective actions. This objective ensures that risks to human health and the environment from impacted groundwater are within protective levels.

Meeting the overall objective requires that several specific project objectives be achieved:

- Effectively plan and scope the UGTA Subproject so that the necessary data are properly collected and relevant evaluations are properly performed.
- Prepare UGTA Subproject plans as guidance and information tools for efficiently conducting the subproject.
- Develop credible predictions of contaminant fate and transport.
- Quantify the risk to human health and the environment, in the absence of any present or future remedial action, to an acceptable level of uncertainty.
- Evaluate an appropriate range of remedial technologies applicable to the various contaminants and impacted media.
- Select appropriate corrective action alternatives.
- Implement selected corrective actions.
- Close the underground test areas.

1.1.3 Subproject Strategy

The Nevada Division of Environmental Protection regulates U.S. Department of Energy's (DOE) Nevada corrective actions through the *Federal Facility Agreement and Consent Order* (FFACO, 1996). Appendix VI of this agreement, "The Corrective Action Strategy," describes the processes that will be used to complete the corrective actions, including those in the UGTA Subproject. The individual sites covered by the agreement are known as Corrective Action Sites (CASs), and they are grouped into Corrective Action Units (CAUs). The UGTA Subproject comprises six CAUs, generally reflecting the geographic locations and geologic and hydrologic environments of the weapons testing areas.

1.1.4 Subproject Organization

Because of the complexity of the problem at hand, the UGTA scope was separated into two major phases. Phase I project activities have focused on a regional investigation. During Phase II, several localized investigations focusing on the CAUs will be conducted.

Phase I has consisted of existing data assessment, groundwater flow and solute transport modeling, and a preliminary risk assessment which has been a key portion of the data assessment activities. The risk assessment has been designed to determine if there is an imminent risk to human health and the environment and to provide input to a value-of-information analysis that will identify and prioritize potential data needs. The results of Phase I will be directly used in developing the work scope for the weapons testing areas and in implementing Phase II. Further information on the Phase I data analysis task is provided in the following subsection.

1.2 Phase I Data Analysis Task Description

This subsection includes a more detailed description of the purpose and scope, objectives, approach, and data requirements and organization of the UGTA Data Analysis Task.

1.2.1 Task Purpose and Scope

The primary purpose of the Data Analysis Task is to compile and analyze existing, as well as new, data. During Phase I, the focus of this analysis task has been a regional investigation. The Phase I Data Analysis Task scope of work includes the evaluation of regional groundwater flow conditions, the transport of tritium from the weapons testing areas, and the determination of the presence or absence of imminent risk to human health and the environment.

1.2.2 Task Objectives

The following were the objectives of the Phase I Data Analysis Task:

- Evaluate the regional groundwater flow conditions using a groundwater flow model.
- Evaluate the transport of tritium in groundwater using a groundwater transport model.
- Develop a preliminary assessment of risk to human health and the environment from the weapons testing areas.

1.2.3 Task Approach

The approach for the Phase I Data Analysis Task has included the following steps:

- Selection of a regional groundwater flow system large enough to encompass the NTS
- Selection of an area of investigation large enough to include the selected regional groundwater flow system
- Collection and analysis of data
- Simulation of regional groundwater flow with a three-dimensional numerical code
- Definition of the major flow paths from the weapons testing areas using a particle-tracking code
- Simulation of the transport of tritium using a numerical, one-dimensional transport code
- Calculations of risk to humans and the environment from exposure to tritiated groundwater

The NTS regional groundwater flow system ([Figure 1-1](#)), which fully encompasses the groundwater flow system underlying the NTS, was selected for this investigation; however, the boundary of this groundwater flow system has not been well defined in some areas. The flow system boundary defined by Waddell et al. (1984) was evaluated at the start of this investigation and is shown on [Figure 1-1](#). The selected area of investigation had to be large enough to allow for a reevaluation and potential expansion of the groundwater flow system boundary. This area covers a large part of Southern Nevada and part of Inyo County in eastern California. The area extends from Death Valley, north to Antelope Valley, and from the Palmetto Mountains east to the Sheep Range, extending over an area of 80,650 square kilometers (31,140 square miles).

Data collection and analysis activities are dictated by the type of data needed. Data types and their methods of analysis are, in turn, dictated by the modeling approach and will not be discussed in this section; however, the documentation of necessary data types and the methods of analysis are discussed in the preceding volumes of this documentation.

The computer code selected to simulate groundwater flow is MODFLOW (McDonald and Harbaugh, 1988). This code was developed by the U.S. Geological Survey (USGS) for the numerical simulation of fully three-dimensional saturated groundwater flow in porous media; and it was also designed to simulate flow under both steady-state and transient conditions. The code

will also be used to simulate flow in fractured media by invoking an equivalent porous media assumption. This assumption implies that, at the scale of the model, the hydraulic behavior of fractured geologic units is analogous to that of porous media.

The code selected to simulate pathlines is MODPATH (Pollock, 1989). This code was developed by the USGS to compute and display three-dimensional pathlines based on results from steady-state simulations from MODFLOW (McDonald and Harbaugh, 1988).

The program uses information on layer geometry, boundary conditions, and flux rates to calculate the velocities and positions of particles at different times. MODPATH was used to compute and display pathlines originating from individual underground nuclear testing locations located throughout the weapons testing areas. MODPATH also provides Darcy velocity distributions along the pathlines, which are required by the transport code.

The code used to simulate contaminant transport is MC-TRANS (IT, 1995), and it was developed specifically for this subproject. This finite-element, one-dimensional, radionuclide transport model is capable of simulating advection in a dual-porosity, fractured system with dispersion, sorption, and first-order decay. The code was used to simulate the concentrations of tritium downgradient from selected nuclear test sites under the “no-action alternative.” The code was used in the stochastic mode to evaluate the uncertainties associated with the predicted tritium concentrations.

The code used to estimate human health risk from exposure to tritium-contaminated groundwater is GW-RISK (IT, 1996a), also developed specifically for this subproject. The code calculates impacts from radiological exposures including intake, dose, and risk; it uses factors derived from U.S. Department of Energy (DOE, 1993), International Commission on Radiation Protection (ICRP, 1991), and U.S. Environmental Protection Agency (EPA) guidance (EPA, 1989a, EPA 1989b; and EPA, 1991). The code uses tritium concentrations simulated by MC-TRANS (IT, 1995) as input for three of the most conservative predicted pathlines. The ecological risk assessment determines tritium concentrations below which no adverse effects to ecological receptors should be expected. These concentrations were compared with measured and modeled tritium concentrations in surface water and groundwater. Although no formal guidance exists on how to assess ecological risks associated with exposure to radionuclides, the general format suggested in the EPA *Framework* document (EPA, 1992) was used in conjunction with published radiation dose models (Baker and Soldat, 1992; Blaylock et al., 1993). Both human and ecological risk assessments included examination of data, exposure assessment, toxicity assessment, risk evaluation, and evaluation of uncertainties.

1.2.4 Task Data Requirements and Organization

Task data requirements and organization are briefly described in this section. Data required to achieve the objectives of the Phase I data analysis are as follows:

- Geologic data for regional groundwater flow and transport modeling
- Hydrologic data for regional groundwater flow modeling
- Transport parameter and tritium source data for Tritium transport modeling
- Risk-related data for assessment of risk to human health and the environment

MODFLOW (McDonald and Harbaugh, 1988) data requirements include hydrogeologic framework data, potentiometric data, hydraulic conductivity/transmissivity data, and groundwater recharge and discharge data. Data needs also include estimates of the uncertainties that are used to define the input variable bounds and the output variable target ranges for use in the model calibration process. MODPATH data requirements are MODFLOW data and porosity data. In addition to the Darcy velocities calculated by MODPATH, the transport model (MC-TRANS) requires transport parameter data including bulk and fracture porosity, dispersion, and tritium matrix diffusion data. Data for the tritium source needed for the transport model include the tritium source initial spatial extent and concentration. Data needed for the risk assessment include the peak tritium concentration generated by the transport model from the flowpath at each receptor location. In addition, exposure scenario, tritium dosimetry, and tritium detriment and risk data are required.

The data analysis task was organized into several subtasks based on the approach and the major types of data needs. Data needs of the flow model were fulfilled under four subtasks: Geologic Model, Potentiometric Data, Groundwater Recharge and Discharge Data, and Hydrologic Parameter Data. Porosity data are needed by both MODPATH and MC-TRANS and were collected, together with data on dispersion and matrix diffusion, under the Transport Parameter Subtask. Data needed to define the source term were collected and analyzed under the Source Term Subtask. Data needed for risk assessment were collected and analyzed under the Risk Assessment Subtask.

1.2.5 Task Documentation

Work performed under the data analysis task is documented in the following eight volumes:

- Volume I - *Geologic Model Documentation Package* (IT, 1996a)
- Volume II - *Potentiometric Data Documentation Package* (IT, 1996b)

- Volume III - *Groundwater Recharge and Discharge Data Documentation Package* (IT, 1996c)
- Volume IV - *Hydrologic Parameter Data Documentation Package* (IT, 1996d)
- Volume V - *Transport Parameter and Source Term Data Documentation Package* (IT, 1996e)
- Volume VI - *Groundwater Flow Model Documentation Package* (IT, 1996f)
- Volume VII - *Tritium Transport Model Documentation Package* (this package)
- Volume VIII - *Risk Assessment Documentation Package* (IT, 1996g)

A separate documentation package was not prepared for the Source Term Subtask; however, results of this subtask are reported in Volume V of the task documentation.

The documentation packages are meant to fulfill several subproject needs. The first five packages serve as a repository of available and pertinent data collected for possible inclusion into the modeling process. There is little relationship between these five packages; instead, they are directly related to Volumes VI (Groundwater Flow) and VII (Tritium Transport), the packages which document the flow and transport modeling process and results. Volume VIII, Risk Assessment, is most directly related to Volume VII (Tritium Transport). Concentrations of tritium at specific locations and times required by the risk assessment are provided by the transport model. [Figure 1-2](#) illustrates how information from each of the packages was used and how the packages related to each other.

A second subproject need was to centralize the required information in order to have it readily available for a highly technical review of the modeling process. The intended audience of these eight documents is the technical reviewer. A summary report of the entire project is contained in the *Regional Groundwater Flow and Tritium Transport Modeling and Risk Assessment of the Underground Test Area, Nevada Test Site, Nevada* (DOE, in press). It contains information related to the regulatory and risk management issues. This document is intended to serve as the primary subproject summary that reaches a broader audience.

1.3 Transport Parameter Data Subtask Description

This subsection includes descriptions of the purpose and scope, objectives, and approach of the Transport Parameter, and Source Term Subtasks.

Figure 1-2
Data Utilization in Phase I Modeling

1.3.1 Subtask Purpose and Scope

The rate at which solutes move in a groundwater system is a function of physical and chemical parameters such as groundwater flow rate, porosity, dispersivity, sorption, and matrix diffusion. The velocity of groundwater is calculated as the groundwater flow rate per unit cross-sectional area divided by the effective porosity. This represents a particle velocity in groundwater in the absence of any other factors that could affect solute movement such as dispersion, sorption, or matrix diffusion. Dispersion, characterized by the dispersivity, is the process of plume spreading that results in concentration decreases. Sorption is the chemical process where solutes attach to solid surfaces. The sorption process is reversible such that solutes can desorb back into the water at a later time. Sorption thus slows the movement of solutes relative to the groundwater. Matrix diffusion is a physical process that also slows the movement of solute relative to the groundwater. Matrix diffusion occurs when solutes moving in the more permeable zones, such as fractures in a geologic unit, diffuse into the less permeable matrix surrounding the fractures. The diffusion process is also reversible. When a solute diffuses back into the permeable zone (fractures) it appears to have moved at a slower rate than the groundwater.

The scope of Phase I data analysis includes tritium only. Other nuclides that are likely to be present in the cavity will be considered during CAU investigations. Since tritium is known to be a non-sorbing radionuclide, sorption will not be discussed further in this document. Porosity is a necessary parameter for the modeling of radionuclide transport in groundwater because porosity affects the velocity with which a radionuclide, including tritium, travels in groundwater.

Tritium movement in groundwater is governed by two factors:

- The velocity of the groundwater
- The tendency of the tritium to diffuse from the fractures into the rock matrix

Porosity is a significant component of both groundwater velocity and matrix diffusion. In fractured media, groundwater moves along the fractures, thus the groundwater velocity is mostly affected by effective fracture porosities which are equal to or less than the total fracture porosities. Measurements of effective fracture porosities are available only from a few transport experiments that were performed at or near the NTS. Solute transport in fractured media is also affected by diffusion into the matrix rock: the greater the matrix porosity, the slower solutes will move in the groundwater system. Matrix porosity data are widely available. The purpose of this subtask, with respect to porosity, was to evaluate the existing porosity data and to summarize

effective porosity data from the few transport experiments. In addition, total fracture porosity data will be summarized as an approximation to the effective fracture porosity.

Movement of solutes in a groundwater system results in spreading (dispersion) of concentration isochron largely as a result of differing flow velocities in heterogeneous and tortuous materials. This spreading is normally simulated as a Fickian diffusion process using a parameter called dispersivity to control the amount of spreading. Dispersivity, as normally used, is not entirely a function of the groundwater system, but is also affected by the amount of averaging inherent in the model and the distance of transport. The available dispersivity measurements were obtained from transport experiments which have been performed at or near the NTS. Additionally, other dispersivity data from the literature will be considered.

An important physical mechanism for retarding the movement of solutes in fractured rocks is matrix diffusion (Grisak and Pickens, 1980; van Genuchten and Wierenga, 1976; Maloszewski and Zuber, 1991; Harrison et al., 1992). Diffusion into pores within the rock matrix removes the radionuclide atom from the faster moving water in the fracture and allows additional contact with sorptive mineral surfaces. The purpose of this part of the subtask is to compile information with which to estimate the attenuation that will occur due to this mechanism so that it can be incorporated into predicting the movement of radionuclides and their resulting activities.

The purpose of the source term subtask was to provide an unclassified tritium source term for the transport modeling subtask. Because inventories of individual shots are classified, it was necessary to use unclassified tritium activities that are averaged over two areas of the NTS.

1.3.2 Subtask Objectives

The objectives of the Transport Parameter Data Subtask are:

- Assemble a data set that provides representative values of matrix and fracture porosity of rocks at the NTS
- Assemble a data set that provides representative estimates of dispersivity values of rocks at the NTS
- Compile readily available data on matrix diffusion for tritium and NTS rocks
- Calculate an average source term for tritium to be used in transport modeling.

1.3.3 Subtask Approach

The general subtask approach includes the following steps:

- Compile and qualify available porosity data
- Perform statistical analysis to calculate mean porosity values and variances for hydrostratigraphic units
- Compile and summarize the limited number of dispersivity values available
- Compile and summarize the limited available data on matrix diffusion
- Provide the unclassified average tritium source term for two areas of the NTS.

The specific approaches used for each transport parameter are described in later sections.

1.4 Document Organization

This document is organized in eight sections as follows:

- Section 1.0 - Introduction
- Section 2.0 - Contains quality assurance protocols
- Section 3.0 - Describes the porosity data and associated analysis
- Section 4.0 - Describes the dispersivity data and associated analysis
- Section 5.0 - Describes the available matrix diffusion data
- Section 6.0 - Describes calculation of the source term for tritium
- Section 7.0 - Lists the references cited

2.0 Quality Control

A Quality Assurance Program has been developed for all activities performed under the Environmental Restoration (ER) Program including the UGTA project. Quality Assurance Measures taken to control quality during the process of generating the products under the different data analysis subtasks include data documentation evaluation, data quality evaluation, checking procedures, software quality assurance, use of standard methodologies, technical and peer reviews, and corroboration through the models.

2.1 Data Documentation Evaluation

During the documentation evaluation process of data, flags are assigned. The five levels of data documentation flags are briefly presented here:

- Level 1: Data are collected in accordance with Nevada Environmental Restoration Program (ERP) subproject quality assurance plans, approved Nevada procedures, and/or participant-specific procedures. This ranking indicates that all supporting documentation for the data is on file and is available for review by data users.
- Level 2: Data are collected in accordance with approved plans and procedures as required for Level 1, with the exception that one or more documentation requirements may be deficient in some way. Examples of data documentation deficiencies may include lost or destroyed field-data collection forms or data acquired using interim or draft procedures.
- Level 3: Data are collected using accepted scientific methodology (e.g., American Society of Testing Materials, U.S. Environmental Protection Agency methods, USGS procedures) and accompanied by supporting and corroborative documentation such as testing apparatus diagrams, field or laboratory notes, and procedures. Documents referenced to qualify submitted data under the Level 3 category are noted and described in Part II of the Data Information Form (DIF).
- Level 4: Data are collected by a participating Nevada ERP organization or another organization not associated with the Nevada ERP prior to the issuance and implementation of project-approved standard policies, procedures, or practices governing data acquisition and qualification. The methods of data collection are documented and traceable; however, the validity and prudence of data use or compliance with referenced procedures is indeterminate. Supporting documentation may or may not exist. Documentation provided to qualify submitted data under Level 4 shall be noted and described in Part II of the Data Information Form.

Level 5: Data are obtained under unknown, undesirable, or uncertain conditions. When data documentation is unknown, any available supporting or helpful descriptions of the intended use and conditions of data capture should be described and listed in Part II of the Data Information Form.

2.2 Data Quality Evaluation

The criteria used to evaluate the different types of required data were dependent on the type of data and the intended usage of the data. Thus, various criteria were used to evaluate data quality. The general procedure assigned one or more flags to each record compiled in the database, indicating the data quality or suitability of the individual data record for the intended usage. Subtask-specific data quality evaluation procedures are described in detail in the corresponding subtask documentation package.

2.3 Checking Procedures

Various checking procedures were designed for quality control purposes. Checking procedures applicable to the UGTA data analysis subtasks include those developed for transcription of data, generation of figures, tables and logs, and performance of calculations. Data compiled by project personnel were subjected to the checking procedures before being added to the ER database. However, the bulk of the ER database is comprised of external, digital databases developed by agencies external to the UGTA project, mainly the National Water Information System data from the USGS. Because project specific procedures do not govern other ER database participants their data were not subjected to the checking procedures described here.

2.4 Software Quality Assurance

Various computer codes were developed in-house to aid in the data analysis subtasks. Codes developed specifically for the UGTA project were subjected to software quality assurance requirements such as providing operating instructions, detailing the theoretical basis for the computations, and documenting verification/validation. Codes developed to load data and perform unit conversion codes used on the Environmental Restoration Data Base Management System (ERDBMS) were also checked.

2.5 Standard Methodologies

Only standard and widely accepted methodologies were used in the development of the interpretive products. The various methodologies used are too numerous to list here; however, they are described and referenced, where appropriate, in the sections discussing their use in the data analysis process.

2.6   *Technical and Peer Reviews*

The review process constitutes an important measure of product quality. It was used throughout the performance of the data analysis activities. The review process consists of technical and peer review processes. The technical review process is internal and is performed by qualified personnel. The peer review process is intended to complement the technical review process and is usually performed by individuals who are independent of the project.

Products generated under the Data Analysis Task were subjected to a continual review process to identify major flaws, if any, in the conceptual model of the groundwater flow system at an early stage. For example, the geologic cross sections and maps were subjected to technical and peer reviews several times during their development.

3.0 Porosity

This section includes descriptions of the role of porosity in radionuclide transport in groundwater, the available porosity data, and the data analysis and associated results.

3.1 Role of Porosity in Radionuclide Transport

As stated earlier, porosity affects the movement of radionuclides in groundwater because it is an important factor in determining the magnitudes of groundwater velocity and matrix diffusion. The velocity of groundwater is calculated as the flow per cross sectional open area. The area open to flow is the interconnected pore space through which water flows and is generally characterized by the effective porosity. The effective porosity can be related to the velocity via the equation:

$$v = \frac{q}{n_e} \quad (1)$$

Where:

- v = mean pore velocity;
- q = groundwater specific discharge; and
- n_e = effective porosity.

In granular materials, the effective porosity is often only slightly smaller than the total porosity (de Marsily, 1986). In fractured media, two components of the porosity can be identified: a fracture porosity and a matrix porosity. Water generally flows through the more permeable fracture openings. Thus, the fracture porosity generally controls the velocity of groundwater. Typically, the matrix porosity of granular materials is on the order of 15 to 40 percent, whereas fracture porosity ranges from less than 0.01 to 10 percent (Freeze and Cherry, 1979). The range of effective porosity in porous media can result in a factor of 2 or 3 variation in pore velocity; but for fractured systems, the effective porosity variation can produce several orders of magnitude variation in pore velocity.

The permeable fractures are separated by blocks of unfractured rock material which constitute the matrix rock. Radionuclides can diffuse into, and sorb onto, the rock matrix. The diffusion and

adsorption processes are governed, in part, by the matrix porosity. Tritium diffuses into the rock matrix, but does not adsorb to its surface.

3.2 Data Types, Sources, Prioritization

3.2.1 Data Types

Often times the measured porosity is a bulk porosity, which is a combination of the matrix and fracture components. For many clastic hydrogeologic units, the matrix porosity is much larger than the fracture porosity, so the bulk porosity is considered a good estimate of the matrix porosity in those cases. In fractured units, the bulk porosity is still a good measure of formation porosity, but may not be as useful for separating the porosity into matrix and fracture (or effective) components.

Methods used to measure the porosity include laboratory measurements on cores, interpretations of geophysical logs, and solute or tracer migration studies. With only a few exceptions, core data generally measure matrix porosity. The scale of the core measurements is as large as the core which can be quite small (often only a few centimeters in length). As a result, core data are best used for matrix porosity. For unfractured granular material of silt size or larger, the matrix porosity may be a good estimate of the effective porosity as well. In finer grained material, such as the argillite of the Eleana and Chainman Formations, the effective porosity will be smaller than the total porosity. To be conservative, the effective porosity of the confining units will be associated with a fracture flow region with a porosity of one to five percent. The remaining porosity will be assigned to the matrix. This assumption is conservative because it likely overestimates velocity in cases where matrix diffusion is small.

Geophysical logs which may be used to estimate porosity include density, sonic (velocity), neutron and resistivity logs. The area of investigation of the geophysical logs can extend out to one meter or so depending on the type of log (Serra, 1984). The larger area of investigation for the geophysical logs will likely encompass fractures in the formation. Thus, the bulk porosity from the geophysical logs is more representative of the formation as a whole rather than a measure of matrix porosity alone.

Based on the data analysis needs and the existing methods of porosity measurement, the following data types were compiled to build the porosity database:

- Well name - name of the well if available, in some cases only the hydrostratigraphic unit (HSU) is known
- Sample depth (m)
- n(E,D) - porosity from electric and density logs
- n(C,D) - porosity from core and density logs
- n(N,D) - porosity from neutron and density logs
- n(C) - porosity from core
- n(D) - porosity from density logs
- n(V) - porosity from velocity logs
- n(N) - porosity from neutron logs
- n(R) - porosity from resistivity logs
- Average porosity - average of all the values reported for that record
- Porosity type - bulk, matrix, fracture
- HSU - hydrostratigraphic unit
- Stratigraphic unit
- Reference
- Source
- DQD_F - Data Quality Documentation Flag

In fractured geologic materials, the effective porosity is best measured using tracer migration tests. A few effective porosity values are available from tracer experiments in the rock units of interest at the NTS. The measurements available were not included in the database, but were summarized and presented in this section. Additional fracture porosity values were obtained from the literature and also summarized below. In these cases, fracture porosity is taken as an approximation to fracture effective porosity.

3.2.2 Data Sources

Sources of porosity data included a variety of geophysical logs including neutron, resistivity, and sonic logs, available from various reports and publications.

3.3 Documentation Evaluation

Data prioritized for documentation and quality evaluation include all compiled porosity data. The level of documentation for each record was assessed to provide the user of the data with some basis for traceability of the reported values. The levels were assigned to each record to assess the documentation available for each data point. The levels assigned do not reflect the accuracy or reliability of the reported data, only the level of documentation.

Level 3: For porosity data, Level 3 was assigned if adherence to the procedures was documented.

- Level 4: The methods of data collection are documented and traceable; however, the validity of data use or compliance with referenced procedures is indeterminate.
- Level 5: Level 5 often was assigned to reported average values of porosity because little other information was provided. A Level 5 rank does not suggest the data are suspect, but rather that the result is not traceable with the information provided.

3.4 Porosity Data

3.4.1 Matrix, Bulk, and Fracture Porosity Databases

The data obtained from reports and documents were separated into two groups. The first group consisted of individual sample porosity values obtained from core or geophysical log interpretation. The second group included data that have been averaged in some way, for example, by well or stratigraphic unit. Also included in the second group are data presented as a range of observed values. The individual data values are presented in [Appendix A](#); the averaged or summarized data are presented in [Appendix B](#). The 26 hydrostratigraphic units used to categorize the rock unit associated with each sample are given in [Table 3-1](#). The correlation of the HSUs to the stratigraphic units defined in the geologic model are presented in the Geologic Model Documentation Package (IT, 1996b). Further simplification to 20 hydrostratigraphic units for modeling is given in IT, 1996f.

In terms of application to the transport model, the matrix and bulk data in [Appendices A and B](#) are considered most useful for estimation of matrix porosity. For the alluvial aquifer (AA), the tertiary sediments (TS), the Death Valley sediments (DVS), and the volcanics undifferentiated (VU), the bulk and matrix porosity data in the Appendices also provide an estimate of effective porosity.

Four other hydrostratigraphic units which are considered confining units (Basal Confining Unit, Tuff Confining Unit, Lower Clastic Confining Unit, and the Upper Clastic Confining Unit) will not be treated as coarse-grained clastic units, but rather as fracture flow dominated units. The Basal Confining Unit (BCU) and Tuff Confining Unit (TCU) are zeolitized ash-fall tuffs. These typically contain clay minerals within the pore space and do not readily conduct water. The Lower Clastic Confining Unit (LCCU) and the Upper Clastic Confining Unit (UCCU) are metamorphosed, or partially metamorphosed sedimentary clastic rocks.

Table 3-1
Descriptions of the Hydrostratigraphic Units

Name	Description
AA	Alluvial Aquifer (REGIONAL)
TMAQ	Uppermost Welded Tuffs (MESA)
TPTC	Laterally Variable Tuffs and Lava Flows of Paintbrush Group
TCTC	Laterally Variable Tuffs and Lava Flows of Calico Hills
TCBCU	Non-welded Tuffs (MESA)
TBAQ	Welded Tuffs Above BCU (MESA) Belted Range Aquifer
BCU	Non-welded Tuffs (MESA)
BAQ	Welded Tuffs (MESA) Basal Aquifer
WTA	Welded Tuff Aquifer
VTA	Vitric Tuff Aquifer
TCU	Tuff Confining Unit Zeolited
TPTA	Topopah Springs Tuff Aquifer
WLA	Wahmonie Lavas Aquifer
VCCU	Volcaniclastic Confining Unit
VU	Volcanics Undifferentiated (REGIONAL)
TS	Tertiary Sediments
DVS	Death Valley Section (REGIONAL)
LCA3	Lower Carbonate Aquifer (Yucca Flat Upper Plate), Upper Carbonate Aquifer
UCCU	Upper Clastic Confining Unit (REGIONAL)
LCA	Lower Carbonate Aquifer (REGIONAL)
LCCU	Lower Clastic Confining Unit (REGIONAL)
LCA1	Lower Carbonate Aquifer (Upper Plate)
LCCU1	Lower Clastic Confining Unit (Upper Plate)
LCA2	Lower Carbonate Aquifer (Lower Plate)
LCCU2	Lower Clastic Confining Unit (Lower Plate)
I	Intrusives (REGIONAL)

3.4.2 Statistical Analysis of Matrix and Bulk Porosity

The porosity data from specific depths or locations, presented in [Appendix A](#), were summarized statistically per HSU. Many records had multiple values of porosity obtained from different methods such as multiple geophysical logs. In those cases, all the values per record were averaged to yield a single value. For each record, the average porosity was sorted by HSU and analyzed statistically to provide an estimate of the mean and variance of the matrix, bulk, and fracture porosity of each HSU. Fracture porosity data is scarce, and what exists is of questionable quality except for two recent IT reports (IT, 1996h; IT, 1996i). However, the matrix and bulk values are summarized in [Table 3-2](#). More detailed statistical summaries are provided in [Appendix C](#).

The results in [Table 3-2](#) can be generalized even further by categorizing the data into five generalized hydrogeological units as shown on [Table 3-3](#). A weighted average porosity for each of the grouped hydrogeologic units shown on [Table 3-3](#) was obtained from the mean values in [Table 3-2](#), weighted by the number of data points. These averages are compared to those derived by other authors, such as Burkhard (1989) for Yucca Flat ([Appendix B](#)), on [Table 3-4](#).

Several conclusions can be drawn from these statistical summaries. First, the alluvial and volcanic units have significantly larger porosities than the Paleozoic carbonate and clastic units. Second, the volcanic aquifers are less porous than the volcanic confining units because aquifer units tend to be welded, which reduces the porosity. The differences in volcanic unit porosity values from [Appendices A](#) and [B](#) may stem from differences in location. Much of the data in [Appendix A](#) are from test holes near Yucca Mountain, whereas most of the data from [Appendix B](#) are from Yucca Flat.

3.4.3 Effective Porosity from Tracer Migration Experiments

To describe large scale movement of solutes in the subsurface, the effective porosity should be obtained from tracer or solute migration experiments. Three studies of tracer or radionuclide movement within or near the NTS have yielded estimates of the effective porosity and are summarized in [Table 3-5](#).

Leap and Belmonte (1992) examined data from the U.S. Geological Survey's Amargosa Tracer Calibration Site (south of the NTS) and determined an effective porosity of 10 percent for a fractured 10-meter thick interval of the Bonanza King dolomite of the lower carbonate aquifer. Burbey and Wheatcraft (1986) used an effective porosity of 32 to 36 percent for the alluvium at the Cambrian site in Frenchman Flat. A preliminary assessment of the tracer experiment at

Table 3-2
Statistical Summary of Porosity Data
(Porosity is in percent of bulk volume)

Hydrostratigraphic Unit	Porosity Type	Mean (Percent of bulk volume)	Variance	Range Min/Max	Number of Points
Alluvial Aquifer	Bulk	36.3	79.8	10 to 35	126
Alluvial Aquifer	Matrix	25.2	32.3	13.4 to 38.6	18
Basal Aquifer	Bulk	14.3	20.9	8.5 to 23	9
Basal Aquifer	Matrix	18.4	28.6	9.1 to 27.1	25
Basal Confining Unit	Matrix	38.3	13.4	33.2 to 45.2	16
Belted Range Aquifer	Bulk	28.4	66.6	19/39	7
Lower Carbonate Aquifer	Bulk	11.7	0.3	11 to 12	3
Lower Carbonate Aquifer	Matrix	3.8	7.5	0.3 to 9.9	18
Lower Carbonate Aquifer	Fracture	9	1	8 to 10	3
Lower Clastic Confining Unit	Matrix	3.3	6.5	0.2 to 10	31
Tuff Confining Unit	Matrix	28.1	64	7.3 to 47.5	75
Topopah Spring Tuff Aquifer	Matrix	23.7	NA	NA	1
Timber Mountain Aquifer	Bulk	16.2	132.5	3.4 to 58.3	332
Timber Mountain Aquifer	Matrix	23.2	172.8	7 to 54	32
Upper Clastic Confining Unit	Matrix	8.8	20.6	1.3 to 22.6	34
Vitric Tuff Aquifer	Matrix	34	84.3	19.9 to 44	17
Welded Tuff Aquifer	Matrix	20	138.1	1.4 to 65	639
Wahmonie Lava Aquifer	Matrix	27.4	13.8	22.3 to 33.5	13
Wahmonie Lava Aquifer	Bulk	16	2.8	14 to 18.7	6
VCU	Matrix	16	13	9.2 to 23.5	28

Table 3-3
Grouping of Hydrostratigraphic Units

Group of Aquifers or confining Units	Hydrostratigraphic Unit
Alluvial Aquifer	Alluvial Aquifer (AA) Tertiary Sediments (TS) Death Valley Section (DVS)
Volcanic Aquifer	Basal Aquifer (BAQ) Timber Mountain Aquifer (TBAQ) Timber Mountain Aquifer (TMA) Vitric Tuff Aquifer (VTA) Welded Tuff Aquifer (WTA) Wahmonie Lava Aquifer (WLA)
Volcanic Confining Units	Basal Confining Unit (BCU) Tuff Confining Unit (TCU) Volcanic Confining Unit (VCU)
Carbonate Aquifer	Lower Carbonate Aquifer (LCA)
Clastic Aquitards	Upper Clastic Confining Unit (UCCU) Lower Clastic Confining Unit (LCCU)

Table 3-4
Summary of Porosity Data for Major Hydrostratigraphic Units
as Compared to Literature Data

Hydrostratigraphic Unit	Porosity Values from this study (Percent of bulk volume)	Porosity Values from literature^a (Percent of bulk volume)
Alluvial Aquifer	34.9	34.8
Volcanic Aquifer	19.1	36.2
Volcanic Confining Units	26.8	45.1
Carbonate Aquifer	4.9	2.5
Clastic Aquitards	6.2	3.6

^aBurkhard (1989)

Table 3-5
Effective Porosity Obtained from Tracer Migration Experiments

Location	Effective Porosity (percent)	Hydrostratigraphic Unit	Reference
U.S. Geological Survey Amargosa Tracer Calibration Site	10	Lower Carbonate Aquifer	Leap and Belmonte (1992)
Wells C and C-1	0.064 to 0.5	Lower Carbonate Aquifer	Winograd and West (1962): analysis using Welty and Gelhar (1989)
Cambric Site	31 to 35	Alluvial Aquifer	Burbey and Wheatcraft (1986)

Wells C and C-1 (Winograd and West, 1962) yields an effective porosity between 0.064 and 0.5 percent for the lower carbonate aquifer.

The effective porosity can be estimated from tracer tests conducted by Winograd and West (1962) at the Water Well C and C-1 site in Yucca Flat. A tracer test was conducted at the southern end of the Yucca Flat in Area 6 of Nevada Test Site to determine the rate of movement of groundwater between two wells 30.5 meters (m) (100 feet [ft]) apart. The objective of the test was to understand whether the drilling mud used at C-1 might be carried by groundwater to the production Well C.

The unconfined aquifer tapped by these wells is fractured limestone of Paleozoic age which, as shown by cores from Well C, transmits water primarily through fractures. The total depth of Well C is 518.5 m (1,701 ft) with 32.9 m (108 ft) of screen at the depth of 478.2 m (1,569 ft) to 511.1 m (1,677 ft). The submersible pump delivered 220 gallons per minute (gpm) creating less than 0.5 ft of drawdown. Well C-1 was drilled to a depth of 520.3 m (1,707 ft). The opening (uncased hole) begins at the depth of 281.6 m (924 ft) to the bottom of the well. The actual distance between the 2 wells is 29.3 m (96 ft) at the water table.

Fluorescein, used as a tracer, was injected in Well C-1. The tracer was clearly seen in a sample collected 252 minutes (t_0) after discharge began. Samples of water were collected periodically for 17 hours after the first appearance of the dye. The concentration of the tracer gradually increased to a maximum in 3 to 4 hours (432 to 492 minutes after discharge began) and then slowly decreased until, in another 4 to 5 hours ($t_e = 672$ to 792 minutes after discharge began), it was no longer visually detectable.

To estimate the effective porosity, the radial flow tracer experiment case of Welty and Gelhar (1989) is used to relate the time to the peak concentration to the pumping rate and porosity thickness product through the relation

$$t_m = \frac{R^2 B_{nb}}{Q} \quad (2)$$

Where:

t_m = time to the peak concentration (assuming a gaussian breakthrough);

R = the distance between wells;

- Q = the discharge rate;
- n = effective porosity; and
- b = tested interval thickness.

Rearranging the equation and using $Q = 0.83$ cubic meters per minute (m^3/min) (29.41 cubic feet per minute [ft^3/min]), $R = 29.3$ m (96 ft), and $t_m = 496$ min, the nb product is found to be 0.04 m (0.12 ft). Using the thickness of 32.9 m (108 ft) from Well C, the effective porosity is 0.5 percent. If the greater thickness from Well C-1 of 239 m (783 ft) is used, then the effective porosity is 0.064 percent.

Other estimates of effective fracture porosity can be determined from fracture aperture measurements of Peters et al. (1984) that ranged from 6 to 67 microns and fracture frequency data from Scott and Castellanos (1984), Maldonado and Koether (1983), and Erickson and Waddell (1985) which lead to average spacings of 0.3 to 6 meters (1 to 19.7 ft). These data yield porosities from 5×10^{-5} percent to 0.02 percent. Erickson and Waddell (1985) used fracture frequency data from well USW H-4 to calculate a fracture porosity using the cubic law for flow in fractures and a full-well transmissivity value. They estimated the fracture porosity to be between 0.01 percent and 0.1 percent. Borg et al. (1976), citing earlier sources, suggested effective porosity ranges of 0.01 percent to 1 percent for the LCA and 0.5 percent to 20 percent for volcanic units on eastern Pahute Mesa.

3.4.4 Fracture Porosity Data and Other Literature Sources

The small number of tracer studies on the NTS limits the applicability of the data to the entire study area. To supplement the tracer studies, data from examination of fractures in core were used to calculate fracture porosity values on the NTS. In addition, fracture porosity data from sites outside the NTS were examined to determine if data from the NTS are representative.

Two recent studies of carbonate (IT, 1996h) and volcanic (IT, 1996i) core provide insights into fracture porosity values. Core from Well ER-6-2 (IT, 1996h) was examined and described with respect to fracture density (number of fracture per 5 foot interval), fracture aperture, and fracture dip angle. In the analysis, only open fractures were included. Sealed fractures were excluded because they are unlikely to transmit much water. The average fracture spacing along the borehole is 1.45 m (4.76 ft). The mean dip angle is 81° and the mean aperture is 0.88 millimeter (0.003 ft). Using the fracture spacing along the borehole and the dip angle, the true fracture spacing is shown to be 0.22 m (0.72 ft). The fracture porosity is 4×10^{-3} , which is estimated as

the aperture divided by the true spacing. This value compares well with the larger value obtained from the tracer test in Wells C and C-1 in [Table 3-5](#).

A similar study (IT, 1996i) of core from 7 wells from Pahute Mesa was conducted to characterize fractures in the volcanic units. A range of fracture porosities, calculated from aperture, density, orientation and percent open area data are presented in [Table 3-6](#).

Several literature sources for fracture porosity were examined to determine if the data from the NTS were consistent with other work from around the world. Lee and Farmer (1993) summarize a large amount of information on fluid flow in fractured rocks. They showed that fracture porosity typically ranges from 5×10^{-6} to 5×10^{-4} for clastic, metavolcanic, and crystalline rocks. This range is similar to the ranges in [Table 3-6](#).

At the Stripa site, in Sweden, the flow porosity is in the range of 1×10^{-5} to 2×10^{-4} (Neretnieks et al., 1989). In the fractured basalts of eastern Washington, Gelhar (1982), measured a porosity of 4.3×10^{-4} using a two-well tracer test.

For carbonate rocks, the measured porosities tend to be larger. In the Culebra Dolomite of eastern New Mexico, a range of values from 2×10^{-4} to 2×10^{-2} has been proposed (Tomasko et al., 1989).

3.5 Summary of Porosity Data

The effective porosity value for the alluvial aquifer seems reasonable because the effective porosity is similar to the matrix and bulk values obtained from core and geophysical log data given in [Table 3-2](#).

The LCA value for effective porosity determined by Leap and Belmonte (1992) is larger than would be expected for a fractured aquifer. The Well C and C-1 values, although approximate, are closer to expectation. The 10 percent value may be accurate for the Amargosa site, but is unlikely to be representative for the NTS as a whole. The Amargosa Tracer Site is a very thin (<10 m) aquifer about 200 m (656.2 ft) below land surface. Those conditions are not typical of the study area as a whole. The lower-bound estimates come from the fracture aperture data and may be as low as 0.01 percent. Upper-bound values from the Amargosa tracer site are about 10 percent. Winograd and Thordardson (1975) also assumed average effective fracture porosities ranging

Table 3-6
Fracture Porosity Obtained from the Study of Volcanic Core

Hydrostratigraphic Unit	Fracture Porosity Range
TMAQ	2.2×10^{-5} to 5.6×10^{-5}
TC	2.6×10^{-6} to 1.3×10^{-4}
TBAQ	1.2×10^{-5} to 1.2×10^{-4}
BAQ	6.1×10^{-6} to 6.1×10^{-5}

from 0.01 to 1 percent for the Lower Carbonate Aquifer beneath Yucca Flat and the Specter Range. This range is similar to the porosity values assumed for the Culebra Dolomite of New Mexico.

For the fractured volcanic rocks, a range of effective porosity values from 2×10^{-6} to 5×10^{-4} appears appropriate. This is a very large range, covering more than two orders of magnitude. As a result, the uncertainty associated with predicting radionuclide velocity will be quite large.

4.0 Dispersion

This section includes descriptions of the role of dispersion in radionuclide transport in groundwater, the available dispersivity data, and the data analysis and associated results.

4.1 Role of Dispersion in Radionuclide Transport

The hydrodynamic dispersion of solutes in groundwater describes the spreading phenomenon at a macroscopic level by the combined action of mechanical dispersion and molecular diffusion (EPA, 1988). Dispersion is a mixing process, the result of which causes dilution of the solute (Freeze and Cherry, 1979). The effect of dispersion is quantified and measured in terms of longitudinal and transverse dispersivities. Assessment of aquifer dispersivity is essential for predicting contaminant plume migration in groundwater. The dispersivities, both the longitudinal and transverse, are key input parameters to the governing transport equation used to estimate the concentration distribution of a solute in groundwater over time and space. The emphasis of this data compilation will be on longitudinal dispersivity because of the planned use of a one-dimensional transport simulation where the transverse dispersivity is not needed.

A critical review of dispersivity observations from 59 different field sites, domestic and abroad, presented by Gelhar et al. (1992) serves as a reference in the selection of dispersivity values. The review compiled extensive tabulations of information on site location, description of aquifer material, average aquifer saturated thickness, hydraulic properties, effective porosity, mean pore velocity, flow configuration, dimensionality of monitoring network, tracer type, method of data interpretation, overall scale of observation, and longitudinal and transverse dispersivities from original sources. This information was used to classify the dispersivity data into three reliability classes. The analysis indicated a trend of systematic increase of the longitudinal dispersivity with observation scale, but the trend is much less clear when the reliability of the data is considered. In Gelhar et al. (1992) the reported longitudinal dispersivities ranged from 10^{-2} to 10^4 m (0.3 to 32,800 ft) for travel distances ranging from 10^{-1} to 10^5 m (0.3 to 330,000 ft); but the largest distance with high reliability data was only 250 m (820 ft), and the longitudinal dispersivity was only 4 m (13 ft). Gelhar et al. (1992) also concluded from the data that overall, dispersivity values did not appear to differ with lithology (porous versus fractured media).

As reported by Gelhar et al. (1992), dispersivity is a parameter that appears to be scale-dependent. Recent literature reviews of published dispersivity values (Gelhar et al., 1992; Neuman, 1990) showed that larger dispersivity values were associated with longer travel distance.

This field-scale dispersivity, which may be scale-dependent, is the parameter of interest for the transport modeling. The scale dependency is still somewhat debated. The data summarized in Gelhar et al. (1992) should not be interpreted to suggest that dispersivity simply grows with distance for any particular plume. At two sites, Borden and Otis Air Force Base, the dispersivity was observed to increase for a limited distance and then reach an asymptote. In Neuman's model (1990), universal scaling is operative over large distances and dispersivity may increase significantly as plumes migrate downgradient. However, many examples exist of long plumes that retain relatively modest dispersion, such as the Cape Cod sewage lagoon plume of LeBlanc (1982). For this work, the assumption is made that dispersivity will not continue to increase as the length of transport increases, but rather, will reach an asymptotic value that will apply over a large travel distance.

Because of the heterogeneities which produce irregular flow patterns at field sites, dispersivity is highly uncertain, the value of which can differ by orders of magnitude from site to site. It is, therefore, a common practice to conduct field-scale tracer tests to obtain dispersivity values suitable for modeling. However, with a site as large and as varied as the NTS, it is simply not practical to conduct tracer tests in enough locations to accurately measure dispersivity. Rather, we will rely on the existing tracer test data available from the NTS and vicinity and supplement that with values from the literature.

4.2 Data Types and Sources

4.2.1 Data Types

The compiled dispersivity data set is used to approximate an appropriate range of values for the transport simulations. The following data types were recorded for each tracer test location:

- Site name - name of the well or test site location
- Site geology - the hydrostratigraphic unit which was tested
- Scale of the test - distance between the source and measuring point
- Test method - the type of test, such as recirculating doublet test or a radial converging
- Analysis method - method used to analyze the tracer breakthrough to get dispersivity
- Longitudinal dispersivity - value in meters
- References - Cited sources for the data or the interpretation

4.2.2 Data Sources

A limited amount of dispersivity data is available from four transport experiments conducted on the NTS. Greater information can be derived from the review paper of Gelhar et al. (1992).

4.3 Data Documentation Evaluation

Assignment of data documentation flags was performed in accordance with Environmental Restoration Program Standard Operating Procedure (SOP) ERD-05-002. These levels were assigned on a per-test basis to assess the documentation available for each data point. The SOP is written with the assumption that procedures and standard methods are available and have been, or could have been, used. In the case of tracer experiments, there are no accepted standard procedures in place. In general all the cited data follow the accepted scientific method for documenting work. As a result, each test is given a Level 4 ranking to signify that compliance with procedures is not known.

4.4 Data Compilation and Analysis

In two cases, the tracer breakthrough data were analyzed by a new method and presented for comparison with published values if available.

The approach is to summarize the few existing tracer experiments, document the range of values obtained by different investigators, and incorporate several recent literature compilations of dispersivity to determine a range of values appropriate for the transport modeling effort.

At the NTS and vicinity, four major tracer tests were conducted in the past thirty years. Section 4.0 describes some of these tests and the corresponding results derived from using different technical approaches.

The data for 3 of the tests summarized in [Table 4-1](#) are described with regard to the aquifer type and geology, test method, tracer type, analytical method and the derived dispersivities.

4.4.1 Amargosa Tracer Calibration Site

The tests were performed at Amargosa Tracer Calibration Site located in the Amargosa Desert in southern Nevada, approximately 24 kilometers (14.9 ft) southwest of Mercury, Nevada (Leap and Belmonte, 1992). The objectives of the tracer tests were to:

Table 4-1
Longitudinal Dispersivity Information Summary

Site Location	Test Site Geology	Scale of Test meters (feet)	Test Method	Analysis Method	Longitudinal Dispersivity (meters)	References
Amargosa Desert, near NTS	Cambrian Bonanza King Dolomite (fractured)	122.8 (403)	Doublet recirculation (tritium, sulfur-35, bromide)	Fitting of Grove's curves	15 to 30.5	Leap & Belmonte, 1992
Yucca Flat, NTS	Fractured Limestone	29.3 (96)	Radial converging (fluorescein) test at C and C-1 wells	Calculated by Welty & Gelhar's equation	0.6 to 1.4	Winograd & West, 1962 (calculation not included)
Cambric Site, Frenchman Flat, NTS	Tuffaceous Alluvium	91.0 (298)	Radial converging with monitoring the elutions of tritium and ³⁶ C1 at pumping well RNM-2S	1. Welty & Gelhar Method	9.6	Thompson, 1991 (calculation not included) Burbey & Wheatcraft, 1986
				2. Sauty's Method	2.0	
				3. Sauty's Method	9.1	Travis et al., 1983 Thompson, 1988; Ogard et al., 1988
				4. Sauty's Method	15.1	

- Determine the apparent longitudinal dispersivity of a fissured and fractured aquifer within the Cambrian Bonanza King dolomite draining the Nevada Test Site
- Determine the effective porosity of the carbonate aquifer
- Study the usefulness of tritium, sulfur-35, and bromide as tracers in this aquifer.

The tests were performed under different recirculating rates and pore pressures. Two fully penetrating wells, aligned parallel with the direction of regional flow, were used for tracer recirculating tests. The injection well was located 122.8 m (403 ft) upgradient of the pumping well, and they were connected together by a PVC pipe. The transmissivity of the aquifer ranges from 4,800 square meters per day (m^2/day) to $10,900 \text{ m}^2/\text{day}$. The storage coefficient is approximately 5×10^{-4} and the regional hydraulic gradient is between 10^{-4} and 10^{-5} . Two other fully penetrating wells in the vicinity were used to collect water samples.

Breakthrough curves were constructed from analyses of effluent samples collected from the pumping well. These curves were matched and compared to synthetic curves constructed from various combinations of porosity and dispersivity using the Grove method (Grove and Beteeni, 1971), which provides a solution to the Fickian dispersion model. Apparent dispersivities of the aquifer were then taken to be those of the best-fit synthetic curves, within an accuracy of $\pm 3.0 \text{ m}$ (9.8 ft).

The results of these tests are as follows:

- Test 1 (tritium as tracer) yielded best-fit apparent dispersivity of 15 m (49 ft) and a porosity of 10 percent
- Test 2 (sulfur-35 in the form of sodium sulfate as tracer) yielded best-fit dispersivity of 22.9 m (75 ft) and a porosity of 10 percent
- In Test 3 (tritium and bromide as tracers), the tritium curve fit yielded an apparent dispersivity of 27.4 m (90 ft) and a porosity of 10 percent; the bromide curve fit yielded an apparent dispersivity of 30.5 m (100 ft) and a porosity of 10 percent. The tests were run at a recirculation rate of 31 percent less than that of Test 1.

The relatively large difference in apparent dispersivity between the sulfur-35 and tritium tests is likely caused by greater adsorption and/or retardation of the more active sulfate ion than that of either the bromide or tritiated water. The 10-percent difference in computed apparent dispersivity

between the two tracers (tritium and bromide) for the same recirculation rate in this test was attributed by the adsorption or retardation difference between tritium and bromide. The difference between Tests 1 and 3 is more difficult to explain. Leap and Belmonte (1992) postulated that the differences were due to changes in fracture openings caused by the increased pressure for the higher flow test. This variation between Tests 1 and 3 emphasizes the typical ranges in dispersivity values at a single site.

4.4.2 Tracer Experiment at Yucca Flat

The tracer test was conducted at the southern end of the Yucca Flat in Area 6 of Nevada Test Site to determine the rate of movement of groundwater between two wells, 30.5 m (100 ft) apart (Winograd and West, 1962). The objective of the test was to understand whether the drilling mud used at C-1 might be carried by groundwater to the production Well C.

The unconfined aquifer tapped by these wells is fractured limestone of Paleozoic age, which, as shown by cores from Well C, transmit water primarily through fractures. The total depth of Well C is 518.5 m (1,701 ft) with 32.9 m (108 ft) of screen at the depth of 478.2 m (1,569 ft) to 511.1 m (1,677 ft). The submersible pump delivered 220 gpm creating less than 0.15 m (0.5 ft) of drawdown. Well C-1 was drilled to a depth of 520.3 m (1,707 ft). The opening (uncased hole) begins at the depth of 281.6 m (924 ft) to the bottom of the well. The actual distance between the two wells is 29.3 m (96 ft) at the water table.

Fluorescein, used as a tracer, was injected in Well C-1. The tracer was clearly seen in a sample collected 252 minutes (t_0) after discharge began. Samples of water were collected periodically for 17 hours after the first appearance of the dye. The concentration of the tracer gradually increased to a maximum in 3 to 4 hours (432 to 492 minutes after discharge began), and then slowly decreased until, in another 4 to 5 hours ($t_e = 672$ to 792 minutes after discharge began), it was no longer detectable with the naked eye.

The velocity of the first arrival was estimated to be 0.12 meters per minute (0.4 feet per minute). However, the peak concentration was not included in the report.

An equation developed by Welty and Gelhar (1989) to estimate the longitudinal dispersivity is as follows:

$$\alpha_L = \frac{t_2 - t_1}{t_m} \left[\frac{16}{3} \frac{R}{t_m} \right]^{1/2} \left[\left[1 - \left(1 - \frac{t_2}{t_m} \right)^* \right]^{1/2} - \left[1 - \left(1 - \frac{t_1}{t_m} \right)^* \right]^{1/2} \right]^{1/2} \quad (3)$$

Where:

- t_1 and t_2 = the times corresponding to the breakthrough concentration at the $C_m e^{-1}$ level; respectively, on both sides of the curve (Figure 4-1);
- t_m = the time when peak concentration occurs;
- " = the longitudinal dispersivity; and
- R = the distance between the injection well and the pumping well.

Since the peak concentration (C_m) is not available, t_1 and t_2 were estimated assuming that the breakthrough curve is a triangular distribution (Figure 4-2), meaning that the following proportionality holds:

$$\frac{t_1 \ \& \ t_0}{462\&252} \ , \ \frac{\frac{C_m}{e}}{C_m} \ , \ \frac{1}{e} \quad (4)$$

This implies that t_1 is not a function of C_m . In other words, t_1 , and also t_2 , can be estimated regardless of C_m . Using Equation (2), t_1 was calculated to be 329 minutes. Likewise, t_2 was estimated to be 632 minutes. Therefore by using Equation (1),

$$" = 0.6 \text{ m (2 ft)}$$

If t_0 is taken as t_1 , and t_e as t_2 (where $t_0 = 252$ minutes and $t_e = 732$ minutes),

$$" = 1.4 \text{ m (4.6 ft)}$$

4.4.3 Cambric Site Test

The Cambric nuclear test was detonated underground in May 1965. Since then, the site has been studied under the Hydrology/Radionuclide Migration Project for the Department of Energy. The nuclear test took place at a depth of 294 m (964 ft) below land surface and below the water table in the tuffaceous alluvium of Frenchman Flat at NTS. There is very slow ambient groundwater movement at the location, and the radionuclides resulting from the test remained in the cavity region. The RNM-1 hole was drilled into the cavity in 1974. An auxiliary well, RNM-2S, was drilled 91 m (298.6 ft) away to a depth of 350 m (1,150 ft). It was pumped continuously at a rate of 2.3 m³/min (600 gpm) from October 1975 until August 1991.

Figure 4-1
Illustration of the Breakthrough-Curve, Pulse-Width Method of Analysis
(after Welty and Gelhar, 1989)

Figure 4-2
Conceptualized Breathrough Curve

The concentrations of radionuclides were monitored. Analyses of water samples showed that the migration velocity of tritium, ^{36}Cl (chlorine-36), ^{85}Kr (krypton-85), ^{99}Tc (technetium-99), ^{106}Ru (ruthenium-106), and ^{129}I (iodine-129) was nearly the same as that of the moving water, from the explosion site to the pumped well (Bryant, 1992). The concentration of ^{239}Pu at the pumping well was below the detection limit of 10^6 atoms per milliliter in water collected at the time of peak tritium concentration. As of 1990, the last samples collected from the cavity showed that the levels of activity of both tritium and ^{85}Kr had fallen almost beyond the limits of detection capability (Thompson, 1991). As water was pumped from the RNM-2S well, ^{85}Kr and tritium have moved away from the cavity at approximately the same rate with ^{85}Kr lagging slightly behind. Other radionuclides such as ^{90}Sr (strontium) and ^{137}Cs (cesium) have decreased considerably in the cavity region during the period of pumping at Well RNM-2S. Less than 0.5 percent of the total ^{90}Sr and 0.0003 percent of the total ^{137}Cs accompanied the tritium to the pumped well, although both isotopes appear to have migrated away from the source zone to some extent.

Two years (1977) after initiation of groundwater pumping from RNM-2S, tritium began to appear in the water collected from RNM-2S. Tritium concentration peaked in 1981 and has been declining since. Although almost 91 percent of the Cambrian source term (tritium) has been pumped out of RNM-2S, continued pumping allows the definition of the tail of the elution curve. The concentrations of tritium and ^{85}Kr (in microCuries per milliliter [$\mu\text{Ci/mL}$]) versus the cumulative volume of water pumped (i.e., the elution curves) are shown in [Figures 4-3 and 4-4](#).

With the above information, we can now estimate the longitudinal dispersivity (") of the porous aquifer with two different approaches:

Welty and Gelhar Method

- Peak concentration $C_m = 7,000 \times 10^{-6} \mu\text{Ci/mL}$
- Cumulative volume of water pumped corresponding to the time at peak concentration, $V_m = 5 \times 10^6$ cubic meters (m^3) (1.76×10^8 cubic feet [ft^3])

The time variables t_1 and t_2 in equation. (1) can be derived by the following procedures:

- The value for C_m/e is $7,000/2.7183 = 2,575.2 \mu\text{Ci/mL}$.
- The cumulative volume corresponds to C_m/e is $2.95 \times 10^6 \text{ m}^3$ ($1.0 \times 10^8 \text{ ft}^3$) (V_1) on the rising limb and $12.5 \times 10^6 \text{ m}^3$ ($4.4 \times 10^8 \text{ ft}^3$) (V_2) on the falling limb ([Figure 4-1](#)).

Figure 4-3
Tritium Concentration in Water Pumped from RNM-2S versus Volume Pumped
(after Thompson, 1991)

Figure 4-4

The ^{85}Kr Concentration in Water Pumped from RNM-2S versus Volume Pumped (after Thompson, 1991)

- Assuming continuous pumping at RNM-2S with a rate of 2.3 m³/min (Q), the time at V₁, V₂, and V_m is calculated by $t = V/Q$:

$$t_1 = 891 \text{ days}$$

$$t_2 = 3,774 \text{ days}$$

$$t_m = 1,510 \text{ days}$$

Using Equation (1) with $R = 91 \text{ m}$ (298 ft), $t_1 = 891 \text{ days}$, $t_2 = 3774 \text{ days}$; and $t_m = 1,510 \text{ days}$, the longitudinal dispersivity (") calculated for the Cambrian experiment is 9.6 m (31.5 ft).

Sauty Model

The transport of tritiated water from the source to the satellite well was compared with Sauty's two-dimensional calculation (1980) for instantaneous tracer injection in a radial, converging flow field that is similar to the RNM tracer tests (Daniels, 1981; Daniels, 1982; Daniels and Thompson, 1984). Sauty provided a series of calculated "type curves" with dimensionless time T_r , and dimensionless concentration C_r for different Peclet numbers (Figure 4-5). The shape of the elution curve depends on the Peclet number, which is inversely proportional to the dispersivity. The smaller the Peclet number, the larger the dispersivity, hence the broader and more skewed the elution peak. Peclet number is defined as (Zheng, 1990):

$$P_e = \frac{v \cdot L}{D} \quad (5)$$

Where:

v = the magnitude of the seepage velocity;

L = a characteristic length, commonly taken as the distance from the source to the point of observation

D = the dispersion coefficient.

Because $D = \alpha v$, as defined in Equation (1) when ignoring the molecular diffusivity, Equation (3) can be reduced to:

$$P_e = \frac{L}{\alpha} \quad (6)$$

Figure 4-5
Type Curves for Instantaneous Tracer Injection in Radial Converging Flow Field:
Comparison with Derivative of Imposed Step Function
(after Sauty, 1980)

To compare the experimental data with the calibrated type curves, the time of experiment has to be converted to a dimensionless T_r and similarly, the observed concentration has to be converted to a dimensionless C_r . A dimensionless time $T_r = 1$ corresponds to the time required to pump the volume of water contained in a cylinder whose radius is the distance from the satellite well to the source. The dimensionless concentration, C_r , is calculated relative to the maximum concentration.

The Sauty model has been applied to the Cambric site data several times. Three applications were performed by the following authors:

Burbey and Wheatcraft (1986)

In the case of Cambric site, the time to pump water from the 91-m (298-ft) radius cylinder from RNM-2S was estimated to be 2,100 days. From this point, the initial tracer breakthrough and the time to peak can be related to T_r . Sauty's type curve fitting those two points corresponds to a Peclet number of 45. The corresponding dispersivity is estimated at 2 m (6.6 ft) ($= 91/45$), which can be derived from Equation (3) or (4).

Burbey and Wheatcraft used this longitudinal dispersivity as an input parameter to a three-dimensional, transient, finite difference transport model called the "Deep Well Disposal Model." In the model, the longitudinal dispersivity was not calibrated (i.e., fixed at 2 m); only the transverse dispersivity was calibrated. They used " $L/T = 1.3$ ", " $L/T = 0.67$ ", and " $L/T = 10.0$ " to produce the tritium concentration hydrograph. They concluded that the transverse dispersivity, " $T = 1.5$ ", would produce the most accurate peak concentration in relation to the field data.

Travis et al. (1983)

Travis and others employed a three-dimensional numerical code "TRACR3D" to the overall transport problem at Cambric site (Daniels, 1983). They also used Sauty's type curves to fit the field elution data for tritium. A good fit was found for data up to a cumulative volume of water pumped from RNM-2S using a Peclet number of 10 (Figure 4-6), but the tritium source had to be adjusted downward to 70 percent of the original estimated value. With $P_e = 10$, the longitudinal dispersivity was estimated to be 9.1 m (29.8 ft). The need to use a reduced initial concentration make this result less reliable than the others.

Figure 4-6

Tritium Concentration Data (X) for RNM-2S Water and Calculated Elution of Tracer after Instantaneous Tracer Injection in a Radial Converging Flow Field for Peclet Number 10
(after Daniels and Thompson, 1984)

Ogard et al. (Thompson, 1988; Ogard, 1988)

In the migration study of tritium and ^{36}Cl , it was found previously that the ^{36}Cl elution at RNM-2S preceded the tritium elution by a significant volume (Thompson, 1988) (Figure 4-7), and researchers at Los Alamos attributed this phenomenon to the "anion exclusion" effect, that is, anions such as chloride were eluted before cations or neutral species such as tritiated water. Anions, being of the same charge as the clays and zeolites in the soil, are repelled and effectively prevented from entering into the intragranular porosity of the soil particles. Though a Sauty-type curve with $P_e = 10$ fits the tritium data through the maximum, a better fit to the tailing portion of the data up to $12 \times 10^6 \text{ m}^3$ ($4.2 \times 10^8 \text{ ft}^3$) of the water pumped can be made with a type curve with a Peclet number of 6 (Figure 4-8). A Peclet number of 6 corresponds to a dispersivity of 15.1 m (49.5 ft). A similar fit to the ^{36}Cl data is shown on Figure 4-9. The difference in slope between data and the Sauty curve at longer pumping time is evident especially for ^{36}Cl , which indicates that a curve with a still lower Peclet number, hence a higher dispersivity, may be expected to fit the subsequent data. For the transport of tritium, the dispersivity for chlorine-36 may not be relevant.

4.4.4 Cheshire (U20n) Site

The Cheshire site is located on the eastern portion of Pahute Mesa in Area 20 of the NTS in southern Nevada. The geologic formation under the mesa is composed of Tertiary rhyolitic lava flows, ashfall tuffs, and welded and non-welded ashflow tuffs to a depth of at least 4,000 m (13,100 ft). Groundwater appears to be under semi-confined and unconfined conditions with the potentiometric surface generally located at depths between 530 m (1,739 ft) and 670 m (2,198 ft).

The Cheshire event (U20n) was detonated at a depth of 1,167 m (3,829 ft), some 544 m (1,785 ft) below the water table in February 1976. The radionuclide analyses from samples collected in the postshot drillback hole (U20n#1DD-h), 200 m (656 ft) away from U20n, showed activity levels well below those expected if the total yield had remained in the vicinity of the cavity. This leads to the suggestion that considerable migration might have occurred (Marsch, 1991). A second test well, U20n#1 was drilled approximately 100 m (328 ft) farther downgradient from the first test well and 300 m (984 ft) from the boundary of the rubble chimney in June 1987. During and after drilling, water samples were collected and analyzed for tritium, ^{99}Tc , ^{125}Sb , and ^{137}Cs . In the July sampling, the highest concentration of tritium found at U20n#1 outside and above the cavity, was $0.62 \mu\text{Ci/mL}$ after pumping a total of 9.7×10^4 gallons. The tritium concentration observed in February 1988 was $0.57 \mu\text{Ci/mL}$ (Marsch, 1992). Both inside and above the cavity, tritium concentration decreased over the course of the observations. This suggests that the peak of the tritium (as well as the other radionuclides) activity pulse has moved out of the cavity (Marsch, 1991). In order to find out whether the observed data at U20n#1 is on

Figure 4-7
Elution of Tritium and ^{36}Cl from RNM-2S
(after Thompson, 1989)

Figure 4-8
Elution of Tritium Compared with Sauty Model
(after Thompson, 1988)

Figure 4-9
Elution of ^{36}Cl Compared with Sauty Model
(after Thompson, 1988)

the front, middle, or tail of the plume, a 14-gpm pump was installed to collect representative samples with minimum disturbance over the next few years.

Unfortunately, the test was terminated in 1989 because of problems related to disposal of high concentration radionuclide samples (verbal communication with Kenneth Marsch, Lawrence Livermore National Laboratory, August 29, 1994). The dispersivity, therefore, cannot be derived from this test.

4.4.5 Dispersivity Estimation through Model Calibration

Borg et al. (1976) and Neuman (1990) reported longitudinal dispersivity obtained from the calibration of numerical solute transport models against hydraulic and concentration data.

The longitudinal dispersivities reported by Borg and others (1976) ranged from 11.6 m (38.1 ft) to 91 m (299 ft) for a wide variety of lithologies, ranging from glacial outwash sand and gravel, basalt lava, to dolomite and limestone. The value was 21.3 m (70 ft) for a sand or gravel deposit, which is the lithology that more closely resembles the tuffaceous alluvium at the Cambrian site (Daniels and Thompson, 1984). The dispersivity for the Bonanza King Formation near Nevada Test Site was estimated to be 15 m (49.2 ft) (Borg et al., 1976).

Neuman (1990) reported that most of the calibrated dispersivities used in his paper were associated with large-scale plumes. The scales were in excess of 100 m (328 ft) and lay below the defined lower confidence limit line and were thus, inconsistent with theoretical results. However, the calibrated dispersivities were found to vary more slowly with the scale of the study than did dispersivities determined by other means. This appears to be because calibration often provides information about the spatial variation of hydraulic conductivities on scales exceeding the dimensions of model subregions (called "zones") within which they are kept constant or allowed to vary at a relatively slow rate. The calibrated dispersivities are associated with a reduced length scale L_r which depends on the dimensions of the zones rather than on the mean travel distance L_s of the plume. The regression analysis showed that L_r increased with the mean travel distance at an average rate proportional to $L_s^{0.5}$. This, in turn, explains that groundwater modelers tended to design the zones of their computational grids in a manner roughly proportional to $L_s^{0.5}$. Neuman (1990) concluded that the scale parameter not only controls dispersivities in a given transport model, but that the scale parameter diminished as the density of information about hydraulic heterogeneity goes up.

4.5 Summary of Dispersivity Data

Several important conclusions related to the selection of longitudinal dispersivity and solute transport modeling for NTS site can be drawn based on the previous studies (Gelhar et al., 1992; Neuman, 1990):

- The longitudinal dispersivity apparently increases with scale (distance from the contaminant source or the spacing between the injection well and the monitoring well). However, it is not clear how increases occur for an individual plume. Data suggest that if dispersivity increases, it is not a smooth monotone function of travel distance.
- As the density of information about hydraulic conductivity increases, the effect of the scale parameter may be reduced.
- The lithology, porous or fractured media, has no significant effect on the dispersivity tested. In other words, dispersivities used for porous media can also be used in fractured media.
- The dispersivity data from the NTS fall within the data summarized by Gelhar et al., 1992.

The values of dispersivity from the NTS are consistent with the data summarized by Gelhar et al. (1992). This means that at the scale of the NTS tests, 30 to 120 m, the associated dispersivities of 0.6 to 30 m (2.0 to 98 ft) are appropriate. At the scale of the regional flow model, which will be on the order of several 10s of kilometers, larger dispersivities will be appropriate based on Gelhar et al. (1992). Therefore, dispersivities on the order of 10 to 1,000 m (30 to 3,200 ft) will be used for the regional flow model.

5.0 Matrix Diffusion

This section includes descriptions of the role of matrix diffusion in radionuclide transport in groundwater, the available matrix diffusion data, and the data analysis and associated results. As matrix diffusion is dependent on both the porous medium and the radionuclide of concern, the discussion will be focused on tritium.

5.1 Role of Matrix Diffusion in Tritium Transport

The diffusion of tritium into the rock matrix is one mechanism that slows the movement of tritium relative the movement of water. As water and tritium flow along a fracture, a concentration gradient develops between the fracture and the water in the rock matrix immediately next to the fracture. This concentration gradient will cause tritium to diffuse from the fracture into the matrix where it will remain for some period of time. At a later time, after the tritium front in the fracture has passed, the concentration gradient reverses, and tritium may move back into the fracture. During the time the tritium is in the matrix, the water in the fracture continues to move. Therefore, the mechanism of matrix diffusion slows the movement of tritium with respect to the movement of water.

5.2 Data Types and Sources

The main factor controlling the diffusion of tritium into the rock matrix is the effective diffusion coefficient which is a function of the tritium diffusion coefficient in water, the tortuosity of the matrix which is defined as the length of the flow path divided by the length of the sample, and the characteristics of fracture coatings. Data types which need to be recorded are as follows:

- Well Name
- Sample Number
- Matrix Porosity
- Diffusion Coefficient of Tritium
- Hydrostratigraphic Unit
- Reference
- Data Documentation Identifier

Very little information was found to define the matrix diffusion characteristics of tritium into rocks at the NTS. Only one publication directly relevant to the diffusivity of tritium on NTS rocks was available (Triay et al., 1993). Several literature sources were consulted to provide other estimates of diffusivity for comparison.

5.3 Data Documentation Evaluation

Assignment of data documentation flags was performed in accordance with Environmental Restoration Program SOP ERD-05-002 as described in Section 2.0. All available diffusivity data in [Table 5-1](#) were assigned a Level 3 to signify that the data were collected using accepted scientific methodology.

5.4 Matrix Diffusion Coefficient Data

Data on matrix diffusion in the rocks of the NTS are summarized in [Table 5-1](#). The hydrostratigraphic units used to categorize the rock unit associated with each sample are given in [Table 3-2](#). The correlation of the HSUs to the stratigraphic units defined in the geologic model are presented in the Geologic Model Documentation Package (Volume I) (IT, 1996b).

5.5 Summary of Matrix Diffusion Data

The effective diffusion coefficient for tritium in the welded tuff aquifer is on the order of 1.0 to 3.5×10^{-6} square centimeter per second (cm^2/sec). However, the data summarized in [Table 5-1](#) are limited for several reasons. First, this represents a small set of data and for only one Hydrostratigraphic Unit. Second, the range of porosity values is narrow compared with all the rock units at the NTS as a whole. Third, these tests were performed on fresh rock surfaces, whereas most *in situ* fractures have some mineral coating, especially in the saturated zone.

The small data set limits the extrapolation of the results to other hydrostratigraphic units at the NTS. This is especially true for the lower carbonate aquifer which will have characteristics that differ significantly from the tuffs at Yucca Mountain. The testing of fresh surfaces provides the most direct access for tritium to diffuse into the rock matrix. If the fracture surface is coated with mineralization, then the diffusion coefficient could be reduced substantially.

The limited on-site data can be supplemented with data and values from the literature. Harrison et al. (1992) modeled diffusion of organic contaminants into clay till in Canada. They used effective diffusion coefficient values in the range of $1.5 \times 10^{-6} \text{ cm}^2/\text{sec}$ ($1.6 \times 10^{-9} \text{ ft}^2/\text{sec}$). In modeling of diffusion of strontium and plutonium in fractured granite, Krishnamoorthy et al. (1992) chose a range of values from 4.8×10^{-7} to $1.9 \times 10^{-6} \text{ cm}^2/\text{sec}$ (5.2×10^{-10} to $2.1 \times 10^{-9} \text{ ft}^2/\text{sec}$). Feenstra et al. (1984) measured diffusion through intact sandstone cores and obtained a range of values from 3.4×10^{-8} to $3.2 \times 10^{-7} \text{ cm}^2/\text{sec}$ (3.7×10^{-11} to $3.4 \times 10^{-10} \text{ ft}^2/\text{sec}$) with a mean of $1.5 \times 10^{-7} \text{ cm}^2/\text{sec}$ ($1.6 \times 10^{-10} \text{ ft}^2/\text{sec}$). In mudstone, Barone et al. (1992) measured a diffusion coefficient of 1.5×10^{-6} to $2.0 \times 10^{-6} \text{ cm}^2/\text{sec}$ (1.6×10^{-9} to $2.2 \times 10^{-9} \text{ ft}^2/\text{sec}$). At the Dremmel site, Hadermann and Heer (1996) obtained diffusion coefficients of $2.5 \times 10^{-7} \text{ cm}^2/\text{sec}$

Table 5-1
Diffusion Coefficients for Tritium

Location or Well	Sample	Porosity (in percent)	Diffusion Coefficient (10^{-6} cm²/sec)	Hydrostratigraphic Unit	DDE_F
USW G-4	737	7	2.2	WTA	3
USW GU-3	304#1	6	1.5	WTA	3
USW GU-3	304#2	6	1.6	WTA	3
USW GU-3	433	10	3.5	WTA	3
USW GU-3	1119	10	2.0	WTA	3
Topopah Outcrop		7	1.0	WTA	3

Source: Triay et al. (1993)

(2.7×10^{-10} ft²/sec) to 1.7×10^{-6} cm²/sec (1.8×10^{-9} ft²/sec). Although not comprehensive, the literature values help to bound the range of values that are plausible. For the modeling, the range of effective diffusion coefficient values will be taken to be 1.0×10^{-7} to 3.0×10^{-6} cm²/sec (1.1×10^{-10} to 3.2×10^{-9} ft²/sec).

6.0 Tritium Source Term

This section includes a description of how the source term for tritium was calculated.

6.1 Role and Rationale for the Development of the Tritium Source Term

Tritium is the only radionuclide that is considered in the regional modeling. Tritium is present in the greatest abundance, is very mobile, and has a relatively simple source term. It is recognized that over a small time scale, on the order of 50 to 100 years, tritium poses the greatest risk to human health. Beyond that timeframe, other radionuclides will need to be considered.

The radiologic source term is the total inventory of radionuclides contained in the subsurface of the NTS. This inventory is classified on a shot-by-shot basis. However on a larger scale, the inventory has recently been declassified (Benjamin, 1995). A declassified inventory is presented for all shots in two areas: all shots on Pahute Mesa, and all shots not on Pahute Mesa. The total activity of each of the fission and fusion isotopes that is present in significant quantities in cavities deeper than 100 m (328 ft) above the water table are summed within each of the two areas.

While the radiologic source term provides information on the total inventory within the cavity, not all of the inventory for most of the isotopes is available for dissolution and transport with the groundwater system. This available inventory is called the radiohydrologic source term, or hydrologic source term, and is the information required as input for the transport model. This data required by the model is an activity per unit volume so an estimate of dissolution volume is required.

In the case of tritium, a simplifying assumption has been made that the radiologic source term and the hydrologic source term are identical. All the tritium present during the event is therefore assumed to be dissolved in the groundwater. The calculation of concentration requires only information on the saturated volume of the cavities. However, if other isotopes were to be modeled, such as cesium, strontium or plutonium, the hydrologic source term would not be identical to the radiologic source term. Assumptions would be required to determine how much of the material was contained within the glassy matrix of the melt glass, what leaching rates were, what the chemical speciation of the isotopes were etc. Until additional information that will be collected from the near-shot wells becomes available, reasonable estimates cannot be made on many of the other isotopes.

6.2 Data Sources

The source of the unclassified radiologic source term was Los Alamos National Laboratories analysis and calculation of classified documents. Cavity volumes were calculated from cavity radius data contained in classified reports.

6.3 Data Analysis

Tritium was the only isotope modeled. Therefore, the radiologic and hydrologic source terms are considered identical. The only information required to estimate the source activity per volume was an estimate of the cavity volumes for each of the two areas. The mass of tritium per event is available as part of a classified database. A suitable volume for each event is the cavity volume, because it is related to the yield of the device and the total mass of tritium produced. Because cavity radius data were available for each of the shots, a volume was calculated for each cavity and summed for the two areas. The average tritium activity for each area is given by

$$\overline{C}_o = \frac{\sum_{i=1}^n M_i}{\sum_{i=1}^n V_i} \quad (7)$$

Where:

C_o = average tritium activity per unit volume (pCi/L)

n = number of events to be averaged

M_i = mass of tritium (pCi) for event i

V_i = cavity volume (L) of event i .

Each of the radiologic source terms for tritium were divided by the calculated volume resulting in the radiohydrologic source term. The values were 8.3×10^8 pCi/L for Pahute Mesa shots and 3.3×10^8 pCi/L for non-Pahute Mesa shots. Inherent in this calculation is the assumption that the porosity of the cavity is unity. Porosity corrections are made later on a shot-by-shot basis.

7.0 References

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Appendix A

Porosity Data Set

The following provides a description of the fields and codes used.

Well name	Common well or hole name. REDBOOK reporting name for wells on the NTS.

Sample Depth	Depth below land surface, at which porosity was measured

n(E,D)	Porosity from electric and density logs

n(C,D)	Porosity from core and density logs

n(N,D)	Porosity from neutron and density logs

n(C)	Porosity from core

n(D)	Porosity from density logs

n(V)	Porosity from velocity logs

n(N)	Porosity from neutron logs

n(R)	porosity from resistivity logs

Average Porosity	Average of all the values reported for that record

Porosity Type	Bulk, matrix, fracture

HSU	Hydrostratigraphic unit corresponding to the tested interval

Stratigraphic Unit	Name of stratigraphic unit corresponding to the tested interval

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Reference	Reference of source document

DDE_F	Data documentation evaluation flag

Appendix A
Porosity Data Set

Well Name	Sample Depth (m)	n(E,D)	n(C,D)	n(N,D)	n(C)	n(D)	n(V)	n(N)	n(R)	Average Porosity	Porosity Type	HSU	Stratigraphic Unit	Reference	DDE-F
U3hx-1	246.9-301.8	46	45	46						45.7	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3hx-1	301.8-355.1	44	45	44						44.3	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3jc-1	256.0-268.2	41	39	39						39.7	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3jc-1	268.2-283.5	42	39	39						40.0	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3jc-1	283.5-326.1	47	47	46						46.7	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3jc-1	326.1-338.3	45	46	46						45.7	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3js-1	291.1-301.8	44	45	42						43.7	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3js-1	301.8-320.0	42	42	41						41.7	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3js-1	320.0-344.4	45	47	44						45.3	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3js-1	344.4-356.6	43	46	44						44.3	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3jt-1	185.9-246.9	45	44	45						44.7	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3jt-1	246.9-283.5	44	42	44						43.3	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3hv	39.6-118.9	38	37	38						37.7	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3hv	118.9-152.4	36	38	36						36.7	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3hv	152.4-164.6	38	38	39						38.3	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3hv	164.6-185.9	42	41	42						41.7	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3hv	185.9-195.1	39	39	40						39.3	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3hy	39.6-109.7		37	39						38	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3hy	109.7-189.0		37	37						37	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3hy	189.0-213.4		39	38						38.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3hy	213.4-225.6		39	37						38	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3hy	225.6-265.2		39	40						39.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3jk	39.6-158.5	42	42	41						41.7	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3jk	158.5-225.6	48	48	47						47.7	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3jk	225.6-283.5	50	46	45						47.0	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3jp	36.6-70.1		40	39						39.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3jp	70.1-121.9		38	39						38.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3jp	121.9-152.4		38	39						38.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3jp	152.4-182.9		42	42						42	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3jp	182.9-222.5		46	47						46.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE6d	499.9-542.5	10								10	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE6d	542.5-570.0	12								12	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE6d	570.0-606.6	14								14	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE6d	606.6-637.0	14								14	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE6d	637.0-685.8	18								18	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE6d	685.8-716.3	28								28	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE1k	489.2-563.9	33								33	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE1k	563.9-609.6	35								35	bulk	AA	Alluvium	Carroll and Muller, 1973	4
Well A	499.9-570.0				31.00					31.00	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	297.2	20.5								20.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	298.7	28								28	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	301.4	17								17	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	303.0-303.6	22								22	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	306.0-306.9	24.8								24.8	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	307.8	28								28	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	309.1	22.5								22.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	310.0	30								30	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	311.8	20.5								20.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	313.9-314.9	20.3								20.3	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	317.0	24								24	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	323.1	22.5								22.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	326.7	27								27	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	328.3-335.3	18.8								18.8	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	338.3	19.5								19.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	348.4-349.0	22								22	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	365.8-369.7	21.5								21.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	371.9	36.5								36.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	374.0-381.0	28.3								28.3	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	384.0	52.5								52.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	390.8	32.5								32.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	393.5	37.5								37.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	397.8	27								27	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	400.5	39								39	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	402.9	27								27	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	407.5-410.3	35.2								35.2	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	411.5	24								24	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE11c	413.9	35								35	bulk	AA	Alluvium	Carroll and Muller, 1973	4

Appendix A
Porosity Data Set

Well Name	Sample Depth (m)	n(E,D)	n(C,D)	n(N,D)	n(C)	n(D)	n(V)	n(N)	n(R)	Average Porosity	Porosity Type	HSU	Stratigraphic Unit	Reference	DDE-F
U3eh-1	61.0-106.7	46	46							46	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3eh-1	106.7-189.0	47	47							47	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3eh-1	189.0-240.8	39	39							39	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3eh-1	240.8-262.1	39	39							39	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3eh-1	262.1-280.4	47	46							46.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3gi-1	61.0-121.9	40	41							40.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3gi-1	132.6-152.4	44	45							44.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3gi-1	152.4-157.0	43	45							44	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3gi-1	170.7-184.4	43	45							44	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3gi-1	189.0-207.3	43	46							44.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3gi-1	207.3-214.9	45	45							45	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3gi-1	225.6-237.7	38	39							38.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3gi-1	237.7-251.5	38	39							38.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3gi-1	251.5-269.7	39	39							39	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3gi-1	269.7-297.2	38	38							38	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3gi-1	297.2-326.1	39	39							39	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3ht-1	173.7-210.3	41	41							41	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3ht-1	210.3-219.5	40	39							39.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3ht-1	225.6-249.9	40	37							38.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3ht-1	249.9-262.1	39	37							38	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3ht-1	262.1-274.3	39	37							38	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3ht-1	274.3-289.6	38	40							39	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3ht-1	289.6-304.8	43	43							43	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3ht-1	304.8-310.9	34	34							34	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3ht-1	310.9-317.0	36	39							37.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3ht-1	317.0-335.3	42	45							43.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3jq-1	42.7-64.0	31	36							33.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3jq-1	71.6-85.3	39	38							38.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3jq-1	85.3-97.5	34	37							35.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3jq-1	97.5-106.7	38	39							38.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3jq-1	121.9-128.0	36	40							38	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3jq-1	128.0-146.3	25	27							26	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3jq-1	146.3-161.5	31	34							32.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3jq-1	161.5-185.9	37	39							38	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3jq-1	185.9-199.6	41	43							42	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U7ad-1	36.6-54.9	38	39							38.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U7ad-1	54.9-61.0	34	35							34.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U7ad-1	61.0-82.3	43	45							44	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U7ad-1	82.3-125.0	39	43							41	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U7ad-1	125.0-158.5	45	47							46	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U7ad-1	158.5-167.6	42	43							42.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U7ad-1	167.6-176.8	45	48							46.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U7h-1	103.6-201.2	38	40							39	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U7h-1	204.2-228.6	40	40							40	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3ig	36.6-100.6	35	36							35.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3ig	100.6-128.0	37	38							37.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3ig	128.0-204.2	35	37							36	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3ig	204.2-225.6	38	41							39.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3ig	225.6-243.8	39	39							39	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3ig	243.8-271.3	40	41							40.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3ig	271.3-283.5	35	34							34.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3ig	283.5-298.7	39	39							39	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3ig	298.7-329.2	40	37							38.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3ig	329.2-362.7	38	38							38	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3ig	262.7-378.0	37	37							37	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3ig	378.0-384.0	50	49							49.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3ig	393.2-405.4	49	49							49	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3ig	405.4-417.6	54	52							53	bulk	AA	Alluvium	Carroll and Muller, 1973	4
U3ig	417.6-460.2	43	42							42.5	bulk	AA	Alluvium	Carroll and Muller, 1973	4
UE18t	95.7-96.0				45.00					45.00	matrix	TMA	Tt=Thirsty Canyon Tuff	Byers and Hawkins, 1981	4
UE18t	115.4-115.7				32.00					32.00	matrix	TMA	Tt=Thirsty Canyon Tuff	Byers and Hawkins, 1981	4
UE18t	126.9				39.00					39.00	matrix	TMA	Tt=Thirsty Canyon Tuff	Byers and Hawkins, 1981	4
UE18t	127.4				37.00					37.00	matrix	TMA	Tt=Thirsty Canyon Tuff	Byers and Hawkins, 1981	4
UE18t	138.9-139.2				54.00					54.00	matrix	TMA	Tgs=Tuffaceous alluvium	Byers and Hawkins, 1981	4
UE18t	233.4-233.7				41.00					41.00	matrix	TMA	Tgs=Tuffaceous alluvium	Byers and Hawkins, 1981	4
UE18t	263.7-264.0				40.00					40.00	matrix	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	280.6-280.9				38.00					38.00	matrix	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4

**Appendix A
Porosity Data Set**

Well Name	Sample Depth (m)	n(E,D)	n(C,D)	n(N,D)	n(C)	n(D)	n(V)	n(N)	n(R)	Average Porosity	Porosity Type	HSU	Stratigraphic Unit	Reference	DDE-F
UE18t	329.6-329.9				16.00					16.00	matrix	TMA	Tmu=Ammonia Tanks Member (upper pt.)	Byers and Hawkins, 1981	4
UE18t	365.1-365.5				8.00					8.00	matrix	TMA	Tmu=Ammonia Tanks Member (upper pt.)	Byers and Hawkins, 1981	4
UE18t	393.3-393.6				26.00					26.00	matrix	TMA	Tmu=Ammonia Tanks Member (upper pt.)	Byers and Hawkins, 1981	4
UE18t	423.4-423.7				25.00					25.00	matrix	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	443.7-444.0				34.00					34.00	matrix	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	479.9-480.2				41.00					41.00	matrix	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	515.4-515.6				24.00					24.00	matrix	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	525.8-526.0				23.00					23.00	matrix	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	549.6-549.8				13.00					13.00	matrix	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	582.8-583.0				10.00					10.00	matrix	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	620.4-620.7				13.00					13.00	matrix	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	654.9-655.1				10.00					10.00	matrix	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	688.4-688.7				7.00					7.00	matrix	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	735.0-735.2				11.00					11.00	matrix	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	774.8-775.1				12.00					12.00	matrix	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	789.2-789.5				9.00					9.00	matrix	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	286.5		39.76			44.00		35.00	19	34.44	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	288.0		39.58			42.00		37.00	25	35.89	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	289.6		31.06			29.00		33.00	20	28.27	bulk	TMA	Tmu=Ammonia Tanks Member (upper pt.)	Byers and Hawkins, 1981	4
UE18t	291.1		27.17			24.00		30.00	22	25.79	bulk	TMA	Tmu=Ammonia Tanks Member (upper pt.)	Byers and Hawkins, 1981	4
UE18t	292.6		20.1			18.00		22.00	15	18.77	bulk	TMA	Tmu=Ammonia Tanks Member (upper pt.)	Byers and Hawkins, 1981	4
UE18t	294.1		18.56			17.00		20.00	11	16.64	bulk	TMA	Tmu=Ammonia Tanks Member (upper pt.)	Byers and Hawkins, 1981	4
UE18t	295.7		19.56			18.00		21.00	14	18.14	bulk	TMA	Tmu=Ammonia Tanks Member (upper pt.)	Byers and Hawkins, 1981	4
UE18t	297.2		17.56			16.00		19.00	13	16.39	bulk	TMA	Tmu=Ammonia Tanks Member (upper pt.)	Byers and Hawkins, 1981	4
UE18t	298.7		14.58			13.00	10	16.00	13	13.32	bulk	TMA	Tmu=Ammonia Tanks Member (upper pt.)	Byers and Hawkins, 1981	4
UE18t	300.2		14.04			13.00	12	15.00	13	13.41	bulk	TMA	Tmu=Ammonia Tanks Member (upper pt.)	Byers and Hawkins, 1981	4
UE18t	301.8		13.51			13.00	10	14.00	11	12.30	bulk	TMA	Tmu=Ammonia Tanks Member (upper pt.)	Byers and Hawkins, 1981	4
UE18t	303.3		12.59			11.00	9	14.00	12	11.72	bulk	TMA	Tmu=Ammonia Tanks Member (upper pt.)	Byers and Hawkins, 1981	4
UE18t	304.8		13.15			11.00	10	15.00	15	12.83	bulk	TMA	Tmu=Ammonia Tanks Member (upper pt.)	Byers and Hawkins, 1981	4
UE18t	306.3		13.15			11.00	11	15.00	16	13.23	bulk	TMA	Tmu=Ammonia Tanks Member (upper pt.)	Byers and Hawkins, 1981	4
UE18t	307.8		14.14			12.00	10	16.00	20	14.43	bulk	TMA	Tmu=Ammonia Tanks Member (upper pt.)	Byers and Hawkins, 1981	4
UE18t	309.4		16.03			15.00	13	17.00	18	15.81	bulk	TMA	Tmu=Ammonia Tanks Member (upper pt.)	Byers and Hawkins, 1981	4
UE18t	310.9		12.75			10.00	10	15.00	12	11.95	bulk	TMA	Tmu=Ammonia Tanks Member (upper pt.)	Byers and Hawkins, 1981	4
UE18t	312.4		12.04			11.00	9	13.00	11	11.21	bulk	TMA	Tmu=Ammonia Tanks Member (upper pt.)	Byers and Hawkins, 1981	4
UE18t	313.9		10.79			8.00	8	13.00	11	10.16	bulk	TMA	Tmu=Ammonia Tanks Member (upper pt.)	Byers and Hawkins, 1981	4
UE18t	315.5		13.51			13.00	12	14.00	14	13.30	bulk	TMA	Tmu=Ammonia Tanks Member (upper pt.)	Byers and Hawkins, 1981	4
UE18t	317.0		16.87			13.00	16	20.00	21	17.37	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	318.5		16.28			13.00	14	19.00	21	16.66	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	320.0		14.71			12.00	14	17.00	16	14.74	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	321.6		18.56			17.00	15	20.00	26	19.31	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	323.1		19.56			18.00	16	21.00	26	20.11	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	324.6		21.55			20.00	17	23.00	28	21.91	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	326.1		21.1			19.00	23	23.00	29	23.02	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	327.7		20.02			19.00	20	21.00	24	20.80	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	329.2		20.22			17.00	18	23.00	24	20.44	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	330.7		19.03			18.00	18	20.00	25	20.01	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	332.2		19.42			15.00	21	23.00	30	21.68	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	333.8		17.56			16.00	16	19.00	21	17.91	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	335.3		15			15.00	14	15.00	17	15.20	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	336.8		11.05			10.00	10	12.00	12	11.01	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	338.3		12.51			12.00	6	13.00	13	11.30	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	339.9		13.58			15.00	9	12.00	12	12.32	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	341.4		14.58			16.00	14	13.00	13	14.12	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	342.9		15			15.00	14	15.00	13	14.40	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	344.4		15.51			16.00	12	15.00	13	14.30	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	345.9		25.11			30.00	14	19.00	13	20.22	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	347.5		19.24			16.00	11	22.00	10	15.65	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	349.0		16.03			17.00	14	15.00	9	14.21	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	350.5		17.12			19.00	13	15.00	9	14.62	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	352.0		16.03			17.00	14	15.00	9	14.21	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	353.6		15.51			16.00	13	15.00	8	13.50	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	355.1		13.04			14.00	12	12.00	7	11.61	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	356.6		12.04			13.00	10	11.00	6	10.41	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	358.1		11.05			12.00	8	10.00	5	9.21	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	359.7		10.61			12.00	9	9.00	5	9.12	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	361.2		10.61			12.00	7	9.00	4	8.52	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	362.7		11.05			12.00	7	10.00	4	8.81	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4

Appendix A
Porosity Data Set

Well Name	Sample Depth (m)	n(E,D)	n(C,D)	n(N,D)	n(C)	n(D)	n(V)	n(N)	n(R)	Average Porosity	Porosity Type	HSU	Stratigraphic Unit	Reference	DDE-F
UE18t	364.2			11.05		12.00	7	10.00	4	8.81	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	365.8			11.05		12.00	8	10.00		10.26	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	367.3			10		10.00	7	10.00		9.25	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	368.8			10		10.00	7	10.00		9.25	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	370.3			12.75		15.00	8	10.00		11.44	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	371.9			11.05		12.00	7	10.00		10.01	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	373.4			10.05		11.00	7	9.00		9.26	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	374.9			9.513		10.00	8	9.00		9.13	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	376.4			8.062		9.00	7	7.00		7.77	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	378.0			9.055		10.00	5	8.00		8.01	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	379.5			9		9.00	6	9.00		8.25	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	381.0			12.37		15.00	6	9.00		10.59	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	382.5			17.46		21.00	12	13.00	6	13.89	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	384.0			19.66		22.00	14	17.00		18.16	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	385.6			16.49		20.00	9	12.00		14.37	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	387.1			17.73		23.00	9	10.00		14.93	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	388.6			20.89		27.00	8	12.00	4	14.38	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	390.1			28.07		30.00	9	26.00	13	21.21	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	391.7			28.71		32.00	19	25.00	29	26.74	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	393.2			29.07		31.00	19	27.00	35	28.21	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	394.7			35.13		38.00	30	32.00	33	33.63	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	396.2			35.53		37.00	37	34.00	37	36.11	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	397.8			32.06		34.00	34	30.00	28	31.61	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	399.3			18.11		20.00	17	16.00	6	15.42	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	400.8			30.37		39.00	11	18.00	9	21.47	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	402.3			43.53		45.00	42	42.00	49	44.31	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	403.9			41.05		43.00	39	39.00	43	41.01	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	405.4			39.53		41.00	41	38.00	33	38.51	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	406.9			36.59		34.00	49	39.00	31	37.92	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	408.4			35.01		36.00	45	34.00	38	37.60	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	410.0			38.12		41.00	39	35.00	26	35.82	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	411.5			38.76		43.00	36	34.00	21	34.55	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	413.0			40.75		45.00	32	36.00	17	34.15	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	414.5			43.29		48.00	38	38.00	15	36.46	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	416.1			42.19		46.00	46	38.00	14	37.24	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	417.6			37.9		43.00	27	32.00	11	30.18	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	419.1			39.76		44.00	25	35.00	11	30.95	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	420.6			37.12		40.00	26	34.00	11	29.62	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	422.1			39.2		43.00	27	35.00	11	31.04	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	423.7			34.59		37.00	27	32.00	9	27.92	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	425.2			34.79		39.00	13	30.00	10	25.36	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	426.7			32.6		35.00	11	30.00	10	23.72	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	428.2			37.9		43.00		32.00	13	31.48	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	429.8			41.65		45.00		38.00	18	35.66	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	431.3			39.88		45.00		34.00	4	30.72	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	432.8			37.22		41.00	38	33.00	15	32.84	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	434.3			37.48		43.00	32	31.00	15	31.70	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	435.9			39.32		44.00	30	34.00	19	33.26	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	437.4			38.12		41.00	31	35.00	21	33.22	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	438.9			11.77		14.00	29	9.00	6	13.95	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	440.4			39.04		45.00	18	32.00	62	39.21	bulk	TMA	Tan=Ash-fill and ash-flow tuff	Byers and Hawkins, 1981	4
UE18t	442.0			24		24.00		24.00	37	27.25	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	443.5			41.11		44.00		38.00	51	43.53	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	445.0			44			46	44.00	99	58.25	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	446.5			39.05		37.00	47	41.00	81	49.01	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	448.1			35.53		34.00	46	37.00	50	40.51	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	449.6			36		36.00	45	36.00	46	39.80	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	451.1			29.02		30.00	44	28.00	35	33.20	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	452.6			35.53		43.00		26.00	17	30.38	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	454.2			28.26		21.00		34.00	33	29.06	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	455.7			27.07		25.00		29.00	22	25.77	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	457.2			20.99		16.00		25.00	18	20.00	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	458.7			10.2		8.00		12.00	6	9.05	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	460.2			9.513		10.00		9.00		9.50	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	461.8			13.04		14.00		12.00		13.01	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	463.3			15.7		18.00		13.00	4	12.68	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	464.8			28.4		38.00		13.00	8	21.85	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4

**Appendix A
Porosity Data Set**

Well Name	Sample Depth (m)	n(E,D)	n(C,D)	n(N,D)	n(C)	n(D)	n(V)	n(N)	n(R)	Average Porosity	Porosity Type	HSU	Stratigraphic Unit	Reference	DDE-F
UE18t	466.3			34.5		34.00	38	35.00	46	37.50	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	467.9			36.01		37.00	47	35.00	49	40.80	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	469.4			17.56		16.00	39	19.00	45	27.31	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	470.9			21.55		23.00		20.00	13	19.39	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	472.4			38.53		37.00		40.00	34	37.38	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	474.0			40.01		39.00	60	41.00	44	44.80	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	475.5			40		40.00	46	40.00	42	41.60	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	477.0			41		41.00	47	41.00	45	43.00	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	478.5			43.1		46.00	53	40.00	46	45.62	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	480.1			42.01		41.00	56	43.00	44	45.20	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	481.6			26.58		18.00	56	33.00	35	33.72	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	483.1			15.03		16.00	23	14.00	13	16.21	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	484.6			10.2		8.00	23	12.00	7	12.04	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	486.2			9.22		7.00	20	11.00	4	10.24	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	487.7			6.671		5.00	21	8.00		10.17	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	489.2			9		9.00	25	9.00		13.00	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	490.7			11.51		12.00	20	11.00		13.63	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	492.3			14.71		17.00	9	12.00		13.18	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	493.8			22.09		24.00	16	20.00	5	17.42	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	495.3			21		21.00	17	21.00	8	17.60	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	496.8			12.51		13.00	19	12.00	4	12.10	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	498.3			25.35		31.00	8	18.00	8	18.07	bulk	TMA	Tdf=Debris flows and breccia	Byers and Hawkins, 1981	4
UE18t	499.9			31.06		29.00	33	33.00	43	33.81	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	501.4			30.7		27.00	36	34.00	58	37.14	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	502.9			34.5		34.00	34	35.00	80	43.50	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	504.4			35.01		34.00	39	36.00	72	43.20	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	506.0			34.59		32.00	47	37.00	80	46.12	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	507.5			35.53		37.00	51	34.00	69	45.31	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	509.0			37.5		37.00	47	38.00	60	43.90	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	510.5			39.53		41.00	54	38.00	59	46.31	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	512.1			31.54		30.00	43	33.00	44	36.31	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	513.6			35.06		33.00	42	37.00	62	41.81	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	515.1			29.71		26.00	35	33.00	60	36.74	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	516.6			30		32	30.00	60	38.00	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4	
UE18t	518.2			26.08		24.00	20	28.00	63	32.22	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	519.7			27.07		25.00	29	29.00	56	33.21	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	521.2			25.08		23.00	32	27.00	52	31.82	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	522.7			21.55		20.00	22	23.00	57	28.71	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	524.3			22.55		24.00	24	21.00	16	21.51	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	525.8			28.5		28.00	12	29.00	56	30.70	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	527.3			19.51		19.00		20.00	18	19.13	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	528.8			16		16.00		16.00	9	14.25	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	530.4			13.58		12.00		15.00	7	11.90	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	531.9			12.59		11.00		14.00	6	10.90	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	533.4			17.56		19.00		16.00	7	14.89	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	534.9			13		13.00	18	13.00	6	12.60	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	536.4			14.04		13.00	25	15.00	7	14.81	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	538.0			14.51		15.00	25	14.00	6	14.90	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	539.5			14		14.00	19	14.00	7	13.60	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	541.0			13.51		13.00	11	14.00	6	11.50	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	542.5			15		15.00	15	15.00	7	13.40	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	544.1			20.02		21.00		19.00	11	17.76	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	545.6			19.56		21.00		18.00	11	17.39	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	547.1			17		17.00		17.00	10	15.25	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	548.6			17.51		17.00	16	18.00	11	15.90	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	550.2			21.55		23.00	16	20.00	11	18.31	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	551.7			19.56		21.00	15	18.00	11	16.91	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	553.2			19.51		20.00	17	19.00	11	17.30	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	554.7			16.51		16.00	13	17.00	10	14.50	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	556.3			16		16.00	16	16.00	9	14.60	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	557.8			16		16.00	16	16.00	9	14.60	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	559.3			18.56		20.00	15	17.00	9	15.91	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	560.8			17.03		16.00	17	18.00	10	15.61	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	562.4			17.51		18.00	19	17.00	10	16.30	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	563.9			16.51		16.00	14	17.00	11	14.90	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	565.4			18.51		19.00	13	18.00	12	16.10	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	566.9			17.56		16.00	13	19.00	12	15.51	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4

**Appendix A
Porosity Data Set**

Well Name	Sample Depth (m)	n(E,D)	n(C,D)	n(N,D)	n(C)	n(D)	n(V)	n(N)	n(R)	Average Porosity	Porosity Type	HSU	Stratigraphic Unit	Reference	DDE-F
UE18t	568.5			15		15.00	14	15.00	11	14.00	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	570.0			15.51		16.00	12	15.00	10	13.70	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	571.5						10			10	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	573.0			10.05		9.00	10	11.00	8	9.61	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	574.5			10.61		9.00	11	12.00	9	10.32	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	576.1			5.099		4.00	7	6.00	5	5.42	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	577.6			4.528		4.00	5	5.00	5	4.71	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	579.1			3.808		2.00	5	5.00	6	4.36	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	580.6			5		5.00	5	5.00	5	5.00	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	582.2			6		6.00	6	6.00	7	6.20	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	583.7			8.631		7.00	10	10.00	11	9.33	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	585.2			9.513		9.00	10	10.00	12	10.10	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	586.7			13.58		12.00	13	15.00	17	14.12	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	588.3			16.12		14.00	15	18.00	19	16.42	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	589.8			13.15		11.00	12	15.00	14	13.03	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	591.3			15.7		13.00	16	18.00	15	15.54	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	592.8			18.51		18.00	13	19.00	21	17.90	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	594.4			14.58		13.00	14	16.00	18	15.12	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	595.9			8.062		7.00	7	9.00	9	8.01	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	597.4			15.7		13.00	15	18.00	17	15.74	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	598.9			10.51		11.00	12	10.00	15	11.70	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	600.5			14.32		11.00	14	17.00	18	14.86	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	602.0			14.71		12.00	14	17.00	18	15.14	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	603.5			14.14		12.00	12	16.00	13	13.43	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	605.0			11.18		9.00	10	13.00	12	11.04	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	606.6			10.61		9.00	11	12.00	13	11.12	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	608.1			11.6		10.00	12	13.00	13	11.92	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	609.6			11.18		9.00	12	13.00	12	11.44	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	611.1			11.6		10.00	13	13.00	12	11.92	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	612.6			10.05		9.00	10	11.00	11	10.21	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	614.2			10.51		10.00	10	11.00	11	10.50	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	615.7			10.05		9.00	12	11.00	11	10.61	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	617.2			12.04		11.00	12	13.00	10	11.61	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	618.7			10.61		9.00	13	12.00	10	10.92	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	620.3			9.618		8.00	11	11.00	9	9.72	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	621.8			8.062		7.00	9	9.00	9	8.41	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	623.3			9.513		9.00	10	10.00	10	9.70	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	624.8			11.77		9.00	13	14.00	12	11.95	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	626.4			11.6		10.00	10	13.00	11	11.12	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	627.9			8.062		7.00	9	9.00	10	8.61	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	629.4			9.22		7.00	10	11.00	11	9.64	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	630.9			6.708		3.00	9	9.00	9	7.34	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	632.5			6.671		5.00	10	8.00	8	7.53	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	634.0			8		8.00	9	8.00	8	8.20	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	635.5			7.517		7.00	8	8.00	7	7.50	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	637.0			6.519		7.00	8	6.00	6	6.70	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	638.6			6.519		6.00	9	7.00	6	6.90	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	640.1			8.515		9.00	8	8.00	7	8.10	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	641.6			9.513		9.00	11	10.00	8	9.50	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	643.1			7		7.00	10	7.00	8	7.80	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	644.7			7		7.00	10	7.00	7	7.60	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	646.2			7.517		7.00	10	8.00	8	8.10	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	647.7			8.062		7.00	9	9.00	8	8.21	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	649.2			8.246		6.00	9	10.00	8	8.25	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	650.7			8.062		7.00	9	9.00	8	8.21	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	652.3			6.519		7.00	8	6.00	7	6.90	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	653.8			5.099		4.00	9	6.00	6	6.02	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	655.3			6.519		6.00	9	7.00	7	7.10	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	656.8			6.671		5.00	8	8.00	8	7.13	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	658.4			7		7.00	8	7.00	7	7.20	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	659.9			9		9.00	12	9.00	8	9.40	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	661.4			7		7.00	7	7.00	7	7.00	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	662.9			9		9.00	11	9.00	9	9.40	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	664.5			9.513		9.00	10	10.00	9	9.50	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	666.0			9.055		8.00	10	10.00	9	9.21	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	667.5			9		9.00	9	9.00	9	9.00	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	669.0			9.513		9.00	10	10.00	9	9.50	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4

**Appendix A
Porosity Data Set**

Well Name	Sample Depth (m)	n(E,D)	n(C,D)	n(N,D)	n(C)	n(D)	n(V)	n(N)	n(R)	Average Porosity	Porosity Type	HSU	Stratigraphic Unit	Reference	DDE-F
UE18t	670.6			10.51		10.00	9	11.00	9	9.90	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	672.1			9.055		8.00	9	10.00	9	9.01	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	673.6			8.062		7.00	9	9.00	9	8.41	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	675.1			8.062		7.00	9	9.00	9	8.41	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	676.7			6		6.00	8	6.00	7	6.60	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	678.2			7.071		6.00	8	8.00	8	7.41	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	679.7			7.517		7.00	9	8.00	9	8.10	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	681.2			9		9.00	9	9.00	9	9.00	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	682.8			9		9.00	9	9.00	10	9.20	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	684.3			9.513		9.00	9	10.00	9	9.30	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	685.8			5		5.00	8	5.00	7	6.00	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	687.3			5		5.00	6	5.00	7	5.60	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	688.8			5.099		4.00	8	6.00	7	6.02	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	690.4			4.528		5.00	6	4.00	6	5.11	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	691.9			4.528		5.00	6	4.00	6	5.11	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	693.4			5.099		4.00	8	6.00	7	6.02	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	694.9			7.071		8.00	8	6.00	7	7.21	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	696.5			3.162		2.00	6	4.00	5	4.03	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	698.0			3.536		3.00	4	4.00	4	3.71	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	699.5			2.915		1.00	5	4.00	4	3.38	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	701.0			3.536		3.00	6	4.00	4	4.11	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	702.6			2.55		2.00	6	3.00	4	3.51	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	704.1			3.536		3.00	5	4.00	5	4.11	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	705.6			4		4.00	4	4.00	5	4.20	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	707.1			3.162		2.00	6	4.00	6	4.23	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	708.7			5.099		6.00	6	4.00	6	5.42	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	710.2			4.528		5.00	6	4.00	5	4.91	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	711.7			5.523		6.00	6	5.00	6	5.70	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	713.2			4		4.00	6	4.00	6	4.80	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	714.8			4.528		5.00	7	4.00	5	5.11	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	716.3			5.701		7.00	6	4.00	6	5.74	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	717.8			4		4.00	6	4.00	6	4.80	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	719.3			5.701		7.00	6	4.00	6	5.74	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	720.9			5.701		7.00	6	4.00	6	5.74	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	722.4			4.528		5.00	6	4.00	6	5.11	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	723.9			4.528		5.00	6	4.00	6	5.11	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	725.4			5.523		6.00	8	5.00	6	6.10	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	726.9			5.099		6.00	6	4.00	6	5.42	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	728.5			4.528		4.00	6	5.00	6	5.11	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	730.0			5.523		5.00	5	6.00	7	5.70	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	731.5			5		5.00	6	5.00	6	5.40	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	733.0			4		4.00	6	4.00	5	4.60	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	734.6			4		4.00	5	4.00	6	4.60	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	736.1			7.649		9.00	8	6.00	6	7.33	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	737.6			4.528		5.00	6	4.00	6	5.11	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	739.1			4.528		5.00	5	4.00	6	4.91	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	740.7			4.528		5.00	6	4.00	6	5.11	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	742.2			5.701		7.00	7	4.00	6	5.94	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	743.7			4.743		6.00	7	3.00	5	5.15	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	745.2			5.701		7.00	6	4.00	5	5.54	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	746.8			5.099		6.00	8	4.00	6	5.82	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	748.3			3.536		4.00	7	3.00	5	4.51	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	749.8			3.162		2.00	7	4.00	5	4.23	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	751.3			4.528		5.00	7	4.00	6	5.31	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	752.9			4.528		5.00	7	4.00	6	5.31	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	754.4			5		5.00	8	5.00	6	5.80	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	755.9			6		6.00	10	6.00	8	7.20	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	757.4			7.28		9.00	8	5.00	6	7.06	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	759.0			5.099		6.00	7	4.00	6	5.62	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	760.5			4.528		5.00	6	4.00	6	5.11	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	762.0			4		4.00	7	4.00	6	5.00	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	763.5			4.528		5.00	7	4.00	7	5.51	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	765.0			5		5.00	10	5.00	7	6.40	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	766.6			6.671		8.00	10	5.00	7	7.33	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	768.1			7.649		9.00	10	6.00	9	8.33	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	769.6			6.671		8.00	10	5.00	8	7.53	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	771.1			8.062		9.00	9	7.00	10	8.61	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4

**Appendix A
Porosity Data Set**

Well Name	Sample Depth (m)	n(E,D)	n(C,D)	n(N,D)	n(C)	n(D)	n(V)	n(N)	n(R)	Average Porosity	Porosity Type	HSU	Stratigraphic Unit	Reference	DDE-F
UE18t	772.7			9.513		10.00	13	9.00	10	10.30	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	774.2			8.515		9.00	11	8.00	8	8.90	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	775.7			8.631		10.00	10	7.00	8	8.73	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	777.2			6.519		7.00	10	6.00	7	7.30	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	778.8			6.083		7.00	9	5.00	7	6.82	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	780.3			7.649		9.00	10	6.00	7	7.93	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	781.8			6.519		7.00	10	6.00	7	7.30	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	783.3			9.055		10.00	11	8.00	9	9.41	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	784.9			10.05		11.00	11	9.00	9	10.01	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	786.4			9.055		10.00	13	8.00	10	10.01	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	787.9			8.062		9.00	11	7.00	9	8.81	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	789.4			7.649		9.00	11	6.00	7	8.13	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18t	791.0			6.671		8.00		5.00		6.56	bulk	TMA	Tmr=Rainier Mesa Member	Byers and Hawkins, 1981	4
UE18r	943.7-946.7				26.50					26.50	matrix	TMA	Tuff of Cat Canyon (Timber Mountain Tuff)	Carr et al., 1968	5
UE18r	1098.5-1100.3				24.20					24.20	matrix	TMA	Rhyolitic lava flow	Carr et al., 1968	5
UE18r	1188.4-1190.9				13.70					13.70	matrix	TMA	Debris flow	Carr et al., 1968	5
UE18r	1283.8-1285.3				18.90					18.90	matrix	TMA	Debris flow	Carr et al., 1968	5
UE18r	1398.4-1402.1				16.10					16.10	matrix	TMA	Debris flow	Carr et al., 1968	5
UE18r	1483.5-1487.1				11.10					11.10	matrix	TMA	Rainier Mesa Member (Timber Mountain Tuff)	Carr et al., 1968	5
UE18r	1520.3-1525.2				9.70					9.70	matrix	TMA	Rainier Mesa Member (Timber Mountain Tuff)	Carr et al., 1968	5
UE18r	1520.3-1525.2				14.60					14.60	matrix	TMA	Rainier Mesa Member (Timber Mountain Tuff)	Carr et al., 1968	5
									10.4	10.4	matrix	WTA	Topopah Spring Member	Price et al., 1993	4
									9.0	9.0	matrix	WTA	Topopah Spring Member	Price et al., 1993	4
									10.8	10.8	matrix	WTA	Topopah Spring Member	Price et al., 1993	4
									10.0	10.0	matrix	WTA	Topopah Spring Member	Price et al., 1993	4
									12.0	12.0	matrix	WTA	Topopah Spring Member	Price et al., 1993	4
									11.7	11.7	matrix	WTA	Topopah Spring Member	Price et al., 1993	4
UE-25a#1	27.2				8.70					8.70	matrix	WTA	Tpcp(Tiva Canyon Tuff-crystal poor)	Schwartz, 1990	3
UE-25a#1	33.2				10.40					10.40	matrix	WTA	Tpcp(Tiva Canyon Tuff-crystal poor)	Schwartz, 1990	3
UE-25a#1	56.4				26.50					26.50	matrix	WTA	Tpcp(Tiva Canyon Tuff-crystal poor)	Schwartz, 1990	3
UE-25a#1	64.8				54.10					54.10	matrix	WTA	Tpcp(Tiva Canyon Tuff-crystal poor)	Schwartz, 1990	3
UE-25a#1	103.1-103.2				19.80					19.80	matrix	WTA	Tptr(Topopah Spring Tuff-crystal-rich)	Schwartz, 1990	3
UE-25a#1	105.5				18.70					18.70	matrix	WTA	Tptr(Topopah Spring Tuff-crystal-rich)	Schwartz, 1990	3
UE-25a#1	111.3				13.40					13.40	matrix	WTA	Tptr(Topopah Spring Tuff-crystal-rich)	Schwartz, 1990	3
UE-25a#1	113.6				14.60					14.60	matrix	WTA	Tptr(Topopah Spring Tuff-crystal-rich)	Schwartz, 1990	3
UE-25a#1	118.2				12.60					12.60	matrix	WTA	Tptr(Topopah Spring Tuff-crystal-rich)	Schwartz, 1990	3
UE-25a#1	119.3				12.90					12.90	matrix	WTA	Tptr(Topopah Spring Tuff-crystal-rich)	Schwartz, 1990	3
UE-25a#1	135.4				14.10					14.10	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	137.16-137.19				14.50					14.50	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	202.5-202.8				12.00					12.00	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	220.4				12.90					12.90	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	222.3				12.40					12.40	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	222.6-222.8				11.00					11.00	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	223.8				10.90					10.90	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	225.4				11.30					11.30	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	234.3				13.20					13.20	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	236.62-236.65				10.10					10.10	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	249.39-249.45				16.40					16.40	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	251.49-251.52				16.60					16.60	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	265.3				15.00					15.00	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	267.0				19.70					19.70	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	275.60-275.63				13.70					13.70	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	278.0				15.10					15.10	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	336.6				8.20					8.20	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	337.5				11.90					11.90	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	342.2-342.4				10.00					10.00	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	350.76-350.79				13.80					13.80	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	352.0				16.20					16.20	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	361.7				18.20					18.20	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	363.1				21.50					21.50	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	378.8				10.10					10.10	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	380.2				9.90					9.90	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	381.1				8.60					8.60	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	381.6				7.60					7.60	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	381.9				8.90					8.90	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	382.5				11.30					11.30	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	383.3				10.20					10.20	matrix	WTA	Tptp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3

**Appendix A
Porosity Data Set**

Well Name	Sample Depth (m)	n(E,D)	n(C,D)	n(N,D)	n(C)	n(D)	n(V)	n(N)	n(R)	Average Porosity	Porosity Type	HSU	Stratigraphic Unit	Reference	DDE-F
UE-25a#1	385.5				13.50					13.50	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	393.5				14.00					14.00	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
UE-25a#1	416.5-416.8				28.00					28.00	matrix	WTA	Tacp(Calico Hills Formation-mafic-poor)	Schwartz, 1990	3
UE-25a#1	417.6				30.90					30.90	matrix	WTA	Tacp(Calico Hills Formation-mafic-poor)	Schwartz, 1990	3
UE-25a#1	421.1				36.00					36.00	matrix	WTA	Tacp(Calico Hills Formation-mafic-poor)	Schwartz, 1990	3
UE-25a#1	430.9				30.90					30.90	matrix	WTA	Tacp(Calico Hills Formation-mafic-poor)	Schwartz, 1990	3
UE-25a#1	434.9				31.60					31.60	matrix	WTA	Tacp(Calico Hills Formation-mafic-poor)	Schwartz, 1990	3
UE-25a#1	441.4				34.20					34.20	matrix	WTA	Tacp(Calico Hills Formation-mafic-poor)	Schwartz, 1990	3
UE-25a#1	448.6				32.90					32.90	matrix	WTA	Tacp(Calico Hills Formation-mafic-poor)	Schwartz, 1990	3
UE-25a#1	454.2				28.10					28.10	matrix	WTA	Tacp(Calico Hills Formation-mafic-poor)	Schwartz, 1990	3
UE-25a#1	471.7-471.9				28.00					28.00	matrix	WTA	Tacp(Calico Hills Formation-mafic-poor)	Schwartz, 1990	3
UE-25a#1	474.0				32.50					32.50	matrix	WTA	Tacp(Calico Hills Formation-mafic-poor)	Schwartz, 1990	3
UE-25a#1	475.8				33.50					33.50	matrix	WTA	Tacp(Calico Hills Formation-mafic-poor)	Schwartz, 1990	3
UE-25a#1	489.2				29.50					29.50	matrix	WTA	Tacp(Calico Hills Formation-mafic-poor)	Schwartz, 1990	3
UE-25a#1	506.6				34.90					34.90	matrix	WTA	Tacp(Calico Hills Formation-mafic-poor)	Schwartz, 1990	3
UE-25a#1	510.0				38.80					38.80	matrix	WTA	Tacp(Calico Hills Formation-mafic-poor)	Schwartz, 1990	3
UE-25a#1	515.7				36.40					36.40	matrix	WTA	Tacp(Calico Hills Formation-mafic-poor)	Schwartz, 1990	3
UE-25a#1	523.7-524.0				37.00					37.00	matrix	WTA	Tacp(Calico Hills Formation-mafic-poor)	Schwartz, 1990	3
USW G-1	229.1				17.93					17.93	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-1	247.0				9.56					9.56	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-1	247.0-247.1				10.00					10.00	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-1	271.4				11.02					11.02	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-1	292.4				14.57					14.57	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-1	310.2				12.99					12.99	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-1	319.2				11.37					11.37	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-1	335.3				14.96					14.96	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-1	350.9				15.63					15.63	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-1	369.0				11.02					11.02	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-1	392.7				3.73					3.73	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-1	406.2				3.35					3.35	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-1	422.2				32.91					32.91	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-1	448.0				36.51					36.51	matrix	WTA	Tacp(Calico Hills Formation-mafic-poor)	Schwartz, 1990	3
USW G-1	461.7				33.75					33.75	matrix	WTA	Tacp(Calico Hills Formation-mafic-poor)	Schwartz, 1990	3
USW G-1	478.9				38.49					38.49	matrix	WTA	Tacp(Calico Hills Formation-mafic-poor)	Schwartz, 1990	3
USW G-1	497.9				33.47					33.47	matrix	WTA	Tacp(Calico Hills Formation-mafic-poor)	Schwartz, 1990	3
USW G-1	508.1				35.25					35.25	matrix	WTA	Tacp(Calico Hills Formation-mafic-poor)	Schwartz, 1990	3
USW G-1	525.0				35.89					35.89	matrix	WTA	Tacp(Calico Hills Formation-mafic-poor)	Schwartz, 1990	3
USW G-1	543.9				23.66					23.66	matrix	WTA	Tacr(Calico Hills Formation-mafic-rich)	Schwartz, 1990	3
USW G-2	242.9				4.00					4.00	matrix	WTA	Tptr(Topopah Spring Tuff-crystal-rich)	Schwartz, 1990	3
USW G-2	242.9				3.00					3.00	matrix	WTA	Tptr(Topopah Spring Tuff-crystal-rich)	Schwartz, 1990	3
USW G-2	242.9				2.00					2.00	matrix	WTA	Tptr(Topopah Spring Tuff-crystal-rich)	Schwartz, 1990	3
USW G-2	242.9				4.00					4.00	matrix	WTA	Tptr(Topopah Spring Tuff-crystal-rich)	Schwartz, 1990	3
USW G-2	249.4				3.00					3.00	matrix	WTA	Tptr(Topopah Spring Tuff-crystal-rich)	Schwartz, 1990	3
USW G-2	289.1				8.00					8.00	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	289.1				10.00					10.00	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	289.1				8.00					8.00	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	289.4				7.00					7.00	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	295.4				7.00					7.00	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	295.4				8.00					8.00	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	295.4				8.00					8.00	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	395.5				22.00					22.00	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	395.5				24.00					24.00	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	465.2-465.4				11.46					11.46	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	475.2-475.3				16.21					16.21	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	475.9				10.00					10.00	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	475.9				10.00					10.00	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	475.9				10.00					10.00	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	475.9				12.00					12.00	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	481.3				9.00					9.00	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	481.3				14.00					14.00	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	481.3				9.00					9.00	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	481.3				12.00					12.00	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	481.7				19.10					19.10	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	482.38-482.41				11.60					11.60	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	484.0				9.00					9.00	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	484.0				7.00					7.00	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	487.68-487.74				16.70					16.70	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3

Appendix A Porosity Data Set

Well Name	Sample Depth (m)	n(E,D)	n(C,D)	n(N,D)	n(C)	n(D)	n(V)	n(N)	n(R)	Average Porosity	Porosity Type	HSU	Stratigraphic Unit	Reference	DDE-F
USW G-2	490.3				14.20					14.20	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	490.3				15.20					15.20	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	491.9				11.10					11.10	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	495.0				11.10					11.10	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	496.4				16.00					16.00	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW G-2	505.7				4.00					4.00	matrix	WTA	Ttp(Topopah Spring Tuff-crystal-poor))	Schwartz, 1990	3
USW GU-3	12.2-12.3				10.76					10.76	matrix	WTA	Tiva Canyon Member	Schwartz, 1990	3
USW GU-3	23.8-23.9				15.26					15.26	matrix	WTA	Tiva Canyon Member	Schwartz, 1990	3
USW GU-3	24.1-24.2				16.54					16.54	matrix	WTA	Tiva Canyon Member	Schwartz, 1990	3
USW GU-3	37.0-37.1				13.94					13.94	matrix	WTA	Tiva Canyon Member	Schwartz, 1990	3
USW GU-3	38.6-38.7				12.45					12.45	matrix	WTA	Tiva Canyon Member	Schwartz, 1990	3
USW GU-3	42.6-42.8				9.16					9.16	matrix	WTA	Tiva Canyon Member	Schwartz, 1990	3
USW GU-3	48.0-48.2				8.73					8.73	matrix	WTA	Tiva Canyon Member	Schwartz, 1990	3
USW GU-3	55.6-55.7				9.88					9.88	matrix	WTA	Tiva Canyon Member	Schwartz, 1990	3
USW GU-3	63.8-63.9				10.47					10.47	matrix	WTA	Tiva Canyon Member	Schwartz, 1990	3
USW GU-3	70.2-70.3				11.46					11.46	matrix	WTA	Tiva Canyon Member	Schwartz, 1990	3
USW GU-3	77.7-77.8				9.88					9.88	matrix	WTA	Tiva Canyon Member	Schwartz, 1990	3
USW GU-3	87.1-87.2				9.27					9.27	matrix	WTA	Tiva Canyon Member	Schwartz, 1990	3
USW GU-3	93.0-93.1				7.60					7.60	matrix	WTA	Tiva Canyon Member	Schwartz, 1990	3
USW GU-3	97.5-97.6				8.33					8.33	matrix	WTA	Tiva Canyon Member????	Schwartz, 1990	3
USW GU-3	103.5-103.7				18.85					18.85	matrix	WTA	Bedded tuff	Schwartz, 1990	3
USW GU-3	110.7-110.9				30.89					30.89	matrix	WTA	Bedded tuff	Schwartz, 1990	3
USW GU-3	131.5-131.8				10.08					10.08	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	132.8-132.9				22.87					22.87	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	137.9-138.0				19.61					19.61	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	145.0-145.1				16.60					16.60	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	149.5-149.6				20.16					20.16	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	158.4-158.5				16.00					16.00	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	165.4-165.5				20.48					20.48	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	171.0-171.1				12.45					12.45	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	178.8-178.9				20.63					20.63	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	182.9-183.0				21.43					21.43	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	192.4-192.5				12.35					12.35	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	198.7-198.8				16.86					16.86	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	204.0-204.1				15.14					15.14	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	208.4-208.6				10.71					10.71	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	211.4-211.5				11.65					11.65	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	217.1-217.3				7.57					7.57	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	229.5-229.6				11.95					11.95	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	234.7-234.8				13.94					13.94	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	242.3-242.4				10.36					10.36	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	251.86-251.95				6.43					6.43	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	255.21-255.24				10.16					10.16	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	261.2-261.3				12.26					12.26	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	266.3-266.4				14.62					14.62	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	280.9-281.0				15.18					15.18	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	286.0-286.1				18.08					18.08	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	290.7-290.8				14.62					14.62	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	300.7-300.8				16.54					16.54	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	312.0-312.1				12.20					12.20	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	325.9-326.1				11.58					11.58	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	330.6-330.8				11.49					11.49	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	336.6-336.7				9.34					9.34	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	342.7-342.8				10.77					10.77	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	364.2-364.4				1.70					1.70	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	365.0-365.2				6.25					6.25	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	370.1-370.3				3.80					3.80	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	376.2-376.3				2.53					2.53	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	380.3-380.4				2.95					2.95	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	392.6-392.7				13.92					13.92	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	393.7-393.8				15.74					15.74	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW GU-3	399.9-400.0				32.19					32.19	matrix	WTA	Calico Hills nonwelded unit	Schwartz, 1990	3
USW GU-3	405.5-405.6				40.53					40.53	matrix	WTA	Calico Hills nonwelded unit	Schwartz, 1990	3
USW GU-3	411.9-412.0				39.83					39.83	matrix	WTA	Calico Hills nonwelded unit	Schwartz, 1990	3
USW GU-3	419.9-420.0				47.64					47.64	matrix	WTA	Calico Hills nonwelded unit	Schwartz, 1990	3
USW GU-3	451.7-451.8				39.21					39.21	matrix	WTA	Calico Hills nonwelded unit	Schwartz, 1990	3
USW GU-3	452.4-452.7				41.99					41.99	matrix	WTA	Calico Hills nonwelded unit	Schwartz, 1990	3

Appendix A
Porosity Data Set

Well Name	Sample Depth (m)	n(E,D)	n(C,D)	n(N,D)	n(C)	n(D)	n(V)	n(N)	n(R)	Average Porosity	Porosity Type	HSU	Stratigraphic Unit	Reference	DDE-F
USW GU-3	452.2-452.5				37.28					37.28	matrix	WTA	Calico Hills nonwelded unit	Schwartz, 1990	3
USW GU-3	456.3-456.5				39.39					39.39	matrix	WTA	Calico Hills nonwelded unit	Schwartz, 1990	3
USW GU-3	458.1-458.2				37.99					37.99	matrix	WTA	Calico Hills nonwelded unit	Schwartz, 1990	3
USW GU-3	467.5-467.6				34.29					34.29	matrix	WTA	Calico Hills nonwelded unit	Schwartz, 1990	3
USW GU-3	472.1-472.3				40.55					40.55	matrix	WTA	Calico Hills nonwelded unit	Schwartz, 1990	3
USW G-4	206.8				15.48					15.48	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW G-4	227.5				14.20					14.20	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW G-4	228.6				20.80					20.80	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW G-4	281.9				16.08					16.08	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW G-4	300.2				11.70					11.70	matrix	WTA	Topopah Spring Member	Schwartz, 1990	3
USW G-4	439.7				37.50					37.50	matrix	WTA	Calico Hills nonwelded unit	Schwartz, 1990	3
USW G-4	460.0				35.30					35.30	matrix	WTA	Calico Hills nonwelded unit	Schwartz, 1990	3
USW G-4	479.3				39.90					39.90	matrix	WTA	Calico Hills nonwelded unit	Schwartz, 1990	3
USW G-4	498.6				34.58					34.58	matrix	WTA	Calico Hills nonwelded unit	Schwartz, 1990	3
USW G-4	516.5				33.88					33.88	matrix	WTA	Calico Hills nonwelded unit	Schwartz, 1990	3
USW G-4	13.1				9.00					9.00	matrix	WTA	Tiva Canyon welded unit	Peters et. al., 1984	4
USW G-4	13.1				7.00					7.00	matrix	WTA	Tiva Canyon welded unit	Peters et. al., 1984	4
USW G-4	13.1				7.00					7.00	matrix	WTA	Tiva Canyon welded unit	Peters et. al., 1984	4
USW G-4	37.8				28.00					28.00	matrix	WTA	Paintbrush nonwelded unit	Peters et. al., 1984	4
USW G-4	37.8				28.00					28.00	matrix	WTA	Paintbrush nonwelded unit	Peters et. al., 1984	4
USW G-4	37.8				25.00					25.00	matrix	WTA	Paintbrush nonwelded unit	Peters et. al., 1984	4
USW G-4	63.4				65.00					65.00	matrix	WTA	Paintbrush nonwelded unit	Peters et. al., 1984	4
USW G-4	63.4				65.00					65.00	matrix	WTA	Paintbrush nonwelded unit	Peters et. al., 1984	4
USW G-4	63.4				65.00					65.00	matrix	WTA	Paintbrush nonwelded unit	Peters et. al., 1984	4
USW G-4	75.3			31*	31.00					31.00	matrix	WTA	Topopah Spring welded unit (contains more than 10% by volume)	Peters et. al., 1984	4
USW G-4	75.3			31*	31.00					31.00	matrix	WTA	Topopah Spring welded unit (contains more than 10% by volume)	Peters et. al., 1984	4
USW G-4	75.3			31*	31.00					31.00	matrix	WTA	Topopah Spring welded unit (contains more than 10% by volume)	Peters et. al., 1984	4
USW G-4	263.3				11.00					11.00	matrix	WTA	Topopah Spring welded unit (contains less than 10% by volume)	Peters et. al., 1984	4
USW G-4	263.3				9.00					9.00	matrix	WTA	Topopah Spring welded unit (contains less than 10% by volume)	Peters et. al., 1984	4
USW G-4	263.3				6.00					6.00	matrix	WTA	Topopah Spring welded unit (contains less than 10% by volume)	Peters et. al., 1984	4
USW G-4	263.3				16.00					16.00	matrix	WTA	Topopah Spring welded unit (contains less than 10% by volume)	Peters et. al., 1984	4
USW G-4	263.3				15.00					15.00	matrix	WTA	Topopah Spring welded unit (contains less than 10% by volume)	Peters et. al., 1984	4
USW G-4	263.3				16.00					16.00	matrix	WTA	Topopah Spring welded unit (contains less than 10% by volume)	Peters et. al., 1984	4
USW G-4	353.0				11.00					11.00	matrix	WTA	Topopah Spring welded unit (contains less than 10% by volume)	Peters et. al., 1984	4
USW G-4	353.0				11.00					11.00	matrix	WTA	Topopah Spring welded unit (contains less than 10% by volume)	Peters et. al., 1984	4
USW G-4	353.0				11.00					11.00	matrix	WTA	Topopah Spring welded unit (contains less than 10% by volume)	Peters et. al., 1984	4
USW G-4	370.3				12*					12	matrix	WTA	Topopah Spring welded unit (contains less than 10% by volume)	Peters et. al., 1984	4
USW G-4	370.3				12*					12	matrix	WTA	Topopah Spring welded unit (contains less than 10% by volume)	Peters et. al., 1984	4
USW G-4	370.3				9*					9	matrix	WTA	Topopah Spring welded unit (contains less than 10% by volume)	Peters et. al., 1984	4
USW G-4	382.8				9.00					9.00	matrix	WTA	Topopah Spring welded unit (contains less than 10% by volume)	Peters et. al., 1984	4
USW G-4	382.8				10.00					10.00	matrix	WTA	Topopah Spring welded unit (contains less than 10% by volume)	Peters et. al., 1984	4
USW G-4	382.8				10.00					10.00	matrix	WTA	Topopah Spring welded unit (contains less than 10% by volume)	Peters et. al., 1984	4
USW G-4	389.5				6.00					6.00	matrix	WTA	Topopah Spring welded unit (contains less than 10% by volume)	Peters et. al., 1984	4
USW G-4	389.5				6.40					6.40	matrix	WTA	Topopah Spring welded unit (contains less than 10% by volume)	Peters et. al., 1984	4
USW G-4	389.5				5.60					5.60	matrix	WTA	Topopah Spring welded unit (contains less than 10% by volume)	Peters et. al., 1984	4
USW G-4	395.9				11.00					11.00	matrix	WTA	Topopah Spring welded unit (Basal Vitrophyre)	Peters et. al., 1984	4
USW G-4	395.9				9.00					9.00	matrix	WTA	Topopah Spring welded unit (Basal Vitrophyre)	Peters et. al., 1984	4
USW G-4	395.9				8.00					8.00	matrix	WTA	Topopah Spring welded unit (Basal Vitrophyre)	Peters et. al., 1984	4
USW G-4	403.6				3.80					3.80	matrix	WTA	Topopah Spring welded unit (Basal Vitrophyre)	Peters et. al., 1984	4
USW G-4	403.6				5.10					5.10	matrix	WTA	Topopah Spring welded unit (Basal Vitrophyre)	Peters et. al., 1984	4
USW G-4	403.6				4.20					4.20	matrix	WTA	Topopah Spring welded unit (Basal Vitrophyre)	Peters et. al., 1984	4
USW G-4	414.2				21*					21	matrix	WTA	Calico Hills nonwelded unit (vitric)	Peters et. al., 1984	4
USW G-4	414.2				24*					24	matrix	WTA	Calico Hills nonwelded unit (vitric)	Peters et. al., 1984	4
USW G-4	414.2				18*					18	matrix	WTA	Calico Hills nonwelded unit (vitric)	Peters et. al., 1984	4
USW G-4	428.2				41*					41	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	428.2				41*					41	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	428.2				41*					41	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	471.8				27.00					27.00	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	471.8				28.00					28.00	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	471.8				31.00					31.00	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	472.7				36*					36	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	472.7				32*					32	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	472.7				30*					30	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	513.9				30.00					30.00	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	513.9				30.00					30.00	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	513.9				30.00					30.00	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	526.7				23.00					23.00	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4

Appendix A
Porosity Data Set

Well Name	Sample Depth (m)	n(E,D)	n(C,D)	n(N,D)	n(C)	n(D)	n(V)	n(N)	n(R)	Average Porosity	Porosity Type	HSU	Stratigraphic Unit	Reference	DDE-F
USW G-4	526.7				21.00					21.00	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	526.7				21.00					21.00	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	529.4				28.00					28.00	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	529.4				23.00					23.00	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	529.4				23.00					23.00	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	539.2				26.00					26.00	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	539.2				26.00					26.00	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	539.2				27.00					27.00	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	541.9				24.00					24.00	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	541.9				27.00					27.00	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	541.9				23.00					23.00	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	541.9				28.00					28.00	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	541.9				29.00					29.00	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	541.9				28.00					28.00	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	544.7				29.00					29.00	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	544.7				26.00					26.00	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	544.7				30.00					30.00	matrix	WTA	Calico Hills nonwelded unit (zeolitized)	Peters et. al., 1984	4
USW G-4	578.8				25.00					25.00	matrix	WTA	Prow Pass welded unit	Peters et. al., 1984	4
USW G-4	578.8				22.00					22.00	matrix	WTA	Prow Pass welded unit	Peters et. al., 1984	4
USW G-4	578.8				25.00					25.00	matrix	WTA	Prow Pass welded unit	Peters et. al., 1984	4
USW G-4	611.4				30.00					30.00	matrix	WTA	Crater Flat nonwelded unit	Peters et. al., 1984	4
USW G-4	611.4				30.00					30.00	matrix	WTA	Crater Flat nonwelded unit	Peters et. al., 1984	4
USW G-4	611.4				26.00					26.00	matrix	WTA	Crater Flat nonwelded unit	Peters et. al., 1984	4
USW G-4	640.4				21.00					21.00	matrix	WTA	Crater Flat nonwelded unit	Peters et. al., 1984	4
USW G-4	640.4				17.00					17.00	matrix	WTA	Crater Flat nonwelded unit	Peters et. al., 1984	4
USW G-4	640.4				19.00					19.00	matrix	WTA	Crater Flat nonwelded unit	Peters et. al., 1984	4
USW G-4	731.8				24.00					24.00	matrix	WTA	Bullfrog welded unit	Peters et. al., 1984	4
USW G-4	731.8				25.00					25.00	matrix	WTA	Bullfrog welded unit	Peters et. al., 1984	4
USW G-4	731.8				25.00					25.00	matrix	WTA	Bullfrog welded unit	Peters et. al., 1984	4
USW G-4	733.7				27.00					27.00	matrix	WTA	Bullfrog welded unit	Peters et. al., 1984	4
USW G-4	733.7				27.00					27.00	matrix	WTA	Bullfrog welded unit	Peters et. al., 1984	4
USW G-4	733.7				27.00					27.00	matrix	WTA	Bullfrog welded unit	Peters et. al., 1984	4
USW GU-3	25.0				15.00					15.00	matrix	WTA	Tiva Canyon welded unit	Peters et. al., 1984	4
USW GU-3	25.0				15.00					15.00	matrix	WTA	Tiva Canyon welded unit	Peters et. al., 1984	4
USW GU-3	36.9				13.00					13.00	matrix	WTA	Tiva Canyon welded unit	Peters et. al., 1984	4
USW GU-3	36.9				14.00					14.00	matrix	WTA	Tiva Canyon welded unit	Peters et. al., 1984	4
USW GU-3	47.2				7.10					7.10	matrix	WTA	Tiva Canyon welded unit	Peters et. al., 1984	4
USW GU-3	47.2				11.00					11.00	matrix	WTA	Tiva Canyon welded unit	Peters et. al., 1984	4
USW GU-3	78.3				6.50					6.50	matrix	WTA	Tiva Canyon welded unit	Peters et. al., 1984	4
USW GU-3	78.3				6.50					6.50	matrix	WTA	Tiva Canyon welded unit	Peters et. al., 1984	4
USW GU-3	96.3				8.90					8.90	matrix	WTA	Tiva Canyon welded unit	Peters et. al., 1984	4
USW GU-3	96.3				8.50					8.50	matrix	WTA	Tiva Canyon welded unit	Peters et. al., 1984	4
USW GU-3	114.0				59.00					59.00	matrix	WTA	Paintbrush nonwelded unit	Peters et. al., 1984	4
USW GU-3	114.0				59.00					59.00	matrix	WTA	Paintbrush nonwelded unit	Peters et. al., 1984	4
USW GU-3	115.2				37.00					37.00	matrix	WTA	Paintbrush nonwelded unit	Peters et. al., 1984	4
USW GU-3	115.2				42.00					42.00	matrix	WTA	Paintbrush nonwelded unit	Peters et. al., 1984	4
USW GU-3	121.0				42.00					42.00	matrix	WTA	Paintbrush nonwelded unit	Peters et. al., 1984	4
USW GU-3	121.0				45.00					45.00	matrix	WTA	Paintbrush nonwelded unit	Peters et. al., 1984	4
USW GU-3	345.0				8.20					8.20	matrix	WTA	Topopah Spring welded unit (contains less than 10% by volume	Peters et. al., 1984	4
USW GU-3	345.0				8.20					8.20	matrix	WTA	Topopah Spring welded unit (contains less than 10% by volume	Peters et. al., 1984	4
USW GU-3	364.8				2.60					2.60	matrix	WTA	Topopah Spring welded unit (Basalt Vitrophyre)	Peters et. al., 1984	4
USW GU-3	364.8				2.10					2.10	matrix	WTA	Topopah Spring welded unit (Basalt Vitrophyre)	Peters et. al., 1984	4
USW GU-3	379.8				6.60					6.60	matrix	WTA	Topopah Spring welded unit (Basalt Vitrophyre)	Peters et. al., 1984	4
USW GU-3	379.8				7.40					7.40	matrix	WTA	Topopah Spring welded unit (Basalt Vitrophyre)	Peters et. al., 1984	4
USW GU-3	399.6				27.00					27.00	matrix	WTA	Calico Hills nonwelded unit (vitric)	Peters et. al., 1984	4
USW GU-3	399.6				42.00					42.00	matrix	WTA	Calico Hills nonwelded unit (vitric)	Peters et. al., 1984	4
USW GU-3	405.7				45.00					45.00	matrix	WTA	Calico Hills nonwelded unit (vitric)	Peters et. al., 1984	4
USW GU-3	405.7				45.00					45.00	matrix	WTA	Calico Hills nonwelded unit (vitric)	Peters et. al., 1984	4
USW GU-3	438.9				45.00					45.00	matrix	WTA	Calico Hills nonwelded unit (vitric)	Peters et. al., 1984	4
USW GU-3	438.9				48.00					48.00	matrix	WTA	Calico Hills nonwelded unit (vitric)	Peters et. al., 1984	4
USW GU-3	456.9				43.00					43.00	matrix	WTA	Calico Hills nonwelded unit (vitric)	Peters et. al., 1984	4
USW GU-3	456.9				43.00					43.00	matrix	WTA	Calico Hills nonwelded unit (vitric)	Peters et. al., 1984	4
USW GU-3	474.0				47.00					47.00	matrix	WTA	Calico Hills nonwelded unit (vitric)	Peters et. al., 1984	4
USW GU-3	474.0				47.00					47.00	matrix	WTA	Calico Hills nonwelded unit (vitric)	Peters et. al., 1984	4
USW GU-3	496.2				39.00					39.00	matrix	WTA	Prow Pass welded unit	Peters et. al., 1984	4
USW GU-3	496.2				39.00					39.00	matrix	WTA	Prow Pass welded unit	Peters et. al., 1984	4
USW GU-3	512.1				33.00					33.00	matrix	WTA	Prow Pass welded unit	Peters et. al., 1984	4

Appendix A Porosity Data Set

Well Name	Sample Depth (m)	n(E,D)	n(C,D)	n(N,D)	n(C)	n(D)	n(V)	n(N)	n(R)	Average Porosity	Porosity Type	HSU	Stratigraphic Unit	Reference	DDE-F
USW GU-3	512.1				31.00					31.00	matrix	WTA	Prow Pass welded unit	Peters et. al., 1984	4
USW GU-3	527.3				24.00					24.00	matrix	WTA	Prow Pass welded unit	Peters et. al., 1984	4
USW GU-3	527.3				24.00					24.00	matrix	WTA	Prow Pass welded unit	Peters et. al., 1984	4
ground water test well	321.9				40.40					40.40	matrix	WTA	Rainier Mesa Member(Oak Spring Formation)	Moore and Garber, 1962	4
ground water test well	357.2				44.00					44.00	matrix	TCU	Tiva Canyon member(Oak Spring Formation)	Moore and Garber, 1962	4
ground water test well B					47.50					47.50	matrix	TCU	Tiva Canyon member(Oak Spring Formation)	Moore and Garber, 1962	4
ground water test well	374.6				46.90					46.90	matrix	TCU	Tiva Canyon member(Oak Spring Formation)	Moore and Garber, 1962	4
ground water test well	400.5				39.70					39.70	matrix	TCU	Tiva Canyon member(Oak Spring Formation)	Moore and Garber, 1962	4
ground water test well	441.4				23.70					23.70	matrix	TPTA	Topopah Spring member(Oak Spring Formation)	Moore and Garber, 1962	4
USW H-1	33.5				44.60	42.80				43.70	matrix	WTA	Paintbrush nonwelded unit	Weeks and Wilson, 1984	4
USW H-1	128.0				21.50	20.50				21.00	matrix	WTA	Topopah Spring welded unit	Weeks and Wilson, 1984	4
USW H-1	129.1				23.20	19.70				21.45	matrix	WTA	Topopah Spring welded unit	Weeks and Wilson, 1984	4
USW H-1	134.9				21.00	20.10				20.55	matrix	WTA	Topopah Spring welded unit	Weeks and Wilson, 1984	4
USW H-1	136.6				18.90	17.40				18.15	matrix	WTA	Topopah Spring welded unit	Weeks and Wilson, 1984	4
USW H-1	142.5				16.80	15.50				16.15	matrix	WTA	Topopah Spring welded unit	Weeks and Wilson, 1984	4
USW H-1	143.3				14.90	13.00				13.95	matrix	WTA	Topopah Spring welded unit	Weeks and Wilson, 1984	4
USW H-1	219.2				17.30	14.90				16.10	matrix	WTA	Topopah Spring welded unit	Weeks and Wilson, 1984	4
USW H-1	221.4				27.80	18.30				23.05	matrix	WTA	Topopah Spring welded unit	Weeks and Wilson, 1984	4
USW H-1	222.1				17.60	14.30				15.95	matrix	WTA	Topopah Spring welded unit	Weeks and Wilson, 1984	4
USW H-1	225.6					15.10				15.10	matrix	WTA	Topopah Spring welded unit	Weeks and Wilson, 1984	4
USW H-1	390.4				15.90	15.60				15.75	matrix	WTA	Topopah Spring welded unit	Weeks and Wilson, 1984	4
USW H-1	390.6				15.50	14.00				14.75	matrix	WTA	Topopah Spring welded unit	Weeks and Wilson, 1984	4
USW H-1	397.9				14.10	11.70				12.90	matrix	WTA	Topopah Spring welded unit	Weeks and Wilson, 1984	4
USW H-1	398.7				10.30	10.90				10.60	matrix	WTA	Topopah Spring welded unit	Weeks and Wilson, 1984	4
USW H-1	405.4					17.70				17.70	matrix	WTA	Topopah Spring welded unit	Weeks and Wilson, 1984	4
USW H-1	405.8					9.50				9.50	matrix	WTA	Topopah Spring welded unit	Weeks and Wilson, 1984	4
USW H-1	530.7					46.10				46.10	matrix	WTA	Calico Hills nonwelded unit	Weeks and Wilson, 1984	4
USW H-1	532.8					40.90				40.90	matrix	WTA	Calico Hills nonwelded unit	Weeks and Wilson, 1984	4
UE25a-1	17.7				6.00					6.00	matrix	WTA	Tiva Canyon Member	Anderson, 1981	4
UE25a-1	31.1				7.30					7.30	matrix	WTA	Tiva Canyon Member	Anderson, 1981	4
UE25a-1	46.7				6.14					6.14	matrix	WTA	Tiva Canyon Member	Anderson, 1981	4
UE25a-1	57.0				22.90					22.90	matrix	WTA	Tiva Canyon Member	Anderson, 1981	4
UE25a-1	61.6				30.10					30.10	matrix	WTA	Tiva Canyon Member	Anderson, 1981	4
UE25a-1	64.6				52.70					52.70	matrix	WTA	Tiva Canyon Member	Anderson, 1981	4
UE25a-1	71.3				52.90					52.90	matrix	WTA	bedded tuff	Anderson, 1981	4
UE25a-1	80.2				51.70					51.70	matrix	WTA	bedded tuff	Anderson, 1981	4
UE25a-1	83.2				27.40					27.40	matrix	WTA	Topopah Spring Member	Anderson, 1981	4
UE25a-1	100.0				21.90					21.90	matrix	WTA	Topopah Spring Member	Anderson, 1981	4
UE25a-1	109.8				13.30					13.30	matrix	WTA	Topopah Spring Member	Anderson, 1981	4
UE25a-1	128.4				15.00					15.00	matrix	WTA	Topopah Spring Member	Anderson, 1981	4
UE25a-1	143.6				18.60					18.60	matrix	WTA	Topopah Spring Member	Anderson, 1981	4
UE25a-1	159.8				17.60					17.60	matrix	WTA	Topopah Spring Member	Anderson, 1981	4
UE25a-1	173.5				17.70					17.70	matrix	WTA	Topopah Spring Member	Anderson, 1981	4
UE25a-1	189.9				18.40					18.40	matrix	WTA	Topopah Spring Member	Anderson, 1981	4
UE25a-1	201.2				7.50					7.50	matrix	WTA	Topopah Spring Member	Anderson, 1981	4
UE25a-1	223.5				11.30					11.30	matrix	WTA	Topopah Spring Member	Anderson, 1981	4
UE25a-1	235.4				13.30					13.30	matrix	WTA	Topopah Spring Member	Anderson, 1981	4
UE25a-1	248.8				9.80					9.80	matrix	WTA	Topopah Spring Member	Anderson, 1981	4
UE25a-1	264.0				8.65					8.65	matrix	WTA	Topopah Spring Member	Anderson, 1981	4
UE25a-1	280.8				10.00					10.00	matrix	WTA	Topopah Spring Member	Anderson, 1981	4
UE25a-1	307.9				11.80					11.80	matrix	WTA	Topopah Spring Member	Anderson, 1981	4
UE25a-1	317.1				11.20					11.20	matrix	WTA	Topopah Spring Member	Anderson, 1981	4
UE25a-1	339.0				8.70					8.70	matrix	WTA	Topopah Spring Member	Anderson, 1981	4
UE25a-1	360.7				8.50					8.50	matrix	WTA	Topopah Spring Member	Anderson, 1981	4
UE25a-1	380.8				8.03					8.03	matrix	WTA	Topopah Spring Member	Anderson, 1981	4
UE25a-1	386.0				12.70					12.70	matrix	WTA	Topopah Spring Member	Anderson, 1981	4
UE25a-1	397.6				6.28					6.28	matrix	WTA	Topopah Spring Member	Anderson, 1981	4
UE25a-1	403.7				30.30					30.30	matrix	WTA	Topopah Spring Member	Anderson, 1981	4
UE25a-1	407.9				27.70					27.70	matrix	WTA	Topopah Spring Member	Anderson, 1981	4
UE25a-1	411.3				24.40					24.40	matrix	WTA	Topopah Spring Member	Anderson, 1981	4
UE25a-1	414.9				23.40					23.40	matrix	WTA	Topopah Spring Member	Anderson, 1981	4
UE25a-1	430.2				30.10					30.10	matrix	WTA	Tuffaceous Beds of Calico Hills	Anderson, 1981	4
UE25a-1	446.3				28.10					28.10	matrix	WTA	Tuffaceous Beds of Calico Hills	Anderson, 1981	4
UE25a-1	462.2				32.10					32.10	matrix	WTA	Tuffaceous Beds of Calico Hills	Anderson, 1981	4
UE25a-1	478.1				29.30					29.30	matrix	WTA	Tuffaceous Beds of Calico Hills	Anderson, 1981	4
UE25a-1	499.4				34.10					34.10	matrix	WTA	Tuffaceous Beds of Calico Hills	Anderson, 1981	4
UE25a-1	514.0				30.70					30.70	matrix	WTA	Tuffaceous Beds of Calico Hills	Anderson, 1981	4

Appendix A
Porosity Data Set

Well Name	Sample Depth (m)	n(E,D)	n(C,D)	n(N,D)	n(C)	n(D)	n(V)	n(N)	n(R)	Average Porosity	Porosity Type	HSU	Stratigraphic Unit	Reference	DDE-F
UE25a-1	530.8				33.80					33.80	matrix	WTA	Tuffaceous Beds of Calico Hills	Anderson, 1981	4
UE25a-1	546.0				20.40					20.40	matrix	WTA	Tuffaceous Beds of Calico Hills	Anderson, 1981	4
UE25a-1	558.8				20.70					20.70	matrix	WTA	Prow Pass Member (Crater Flat Tuff)	Anderson, 1981	4
UE25a-1	561.6				33.10					33.10	matrix	WTA	Prow Pass Member (Crater Flat Tuff)	Anderson, 1981	4
UE25a-1	575.6				24.70					24.70	matrix	WTA	Prow Pass Member (Crater Flat Tuff)	Anderson, 1981	4
UE25a-1	592.1				20.30					20.30	matrix	WTA	Prow Pass Member (Crater Flat Tuff)	Anderson, 1981	4
UE25a-1	606.1				13.30					13.30	matrix	WTA	Prow Pass Member (Crater Flat Tuff)	Anderson, 1981	4
UE25a-1	619.5				22.30					22.30	matrix	WTA	Prow Pass Member (Crater Flat Tuff)	Anderson, 1981	4
UE25a-1	633.5				20.00					20.00	matrix	WTA	Prow Pass Member (Crater Flat Tuff)	Anderson, 1981	4
UE25a-1	642.7				21.90					21.90	matrix	WTA	Prow Pass Member (Crater Flat Tuff)	Anderson, 1981	4
UE25a-1	655.2				22.30					22.30	matrix	WTA	Prow Pass Member (Crater Flat Tuff)	Anderson, 1981	4
UE25a-1	658.2				9.68					9.68	matrix	WTA	Prow Pass Member (Crater Flat Tuff)	Anderson, 1981	4
UE25a-1	671.0				15.40					15.40	matrix	WTA	Prow Pass Member (Crater Flat Tuff)	Anderson, 1981	4
UE25a-1	685.1				23.00					23.00	matrix	WTA	Prow Pass Member (Crater Flat Tuff)	Anderson, 1981	4
UE25a-1	701.2				18.40					18.40	matrix	WTA	Prow Pass Member (Crater Flat Tuff)	Anderson, 1981	4
UE25a-1	710.7				15.90					15.90	matrix	WTA	Prow Pass Member (Crater Flat Tuff)	Anderson, 1981	4
UE25a-1	724.7				23.50					23.50	matrix	WTA	Bullfrog Member (crater Flat Tuff)	Anderson, 1981	4
UE25a-1	743.9				17.50					17.50	matrix	WTA	Bullfrog Member (crater Flat Tuff)	Anderson, 1981	4
UE25a-1	760.7				17.40					17.40	matrix	WTA	Bullfrog Member (crater Flat Tuff)	Anderson, 1981	4
UE-25b#1	226				12.00	12.00				12.00	matrix	WTA	Topopah Spring Member of Paintbrush Tuff	Lobmeyer et. al., 1983	4
UE-25b#1	479				28.00	25.00				26.50	matrix	WTA	Tuffaceous Beds of Calico Hills	Lobmeyer et. al., 1983	4
UE-25b#1	485				43.00	40.00				41.50	matrix	WTA	Tuffaceous Beds of Calico Hills	Lobmeyer et. al., 1983	4
UE-25b#1	626				25.00	24.00				24.50	matrix	WTA	Prow Pass Member (Crater Flat Tuff)	Lobmeyer et. al., 1983	4
UE-25b#1	680				14.00	10.00				12.00	matrix	WTA	Prow Pass Member (Crater Flat Tuff)	Lobmeyer et. al., 1983	4
UE-25b#1	753				23.00	23.00				23.00	matrix	WTA	Bullfrog Member (crater Flat Tuff)	Lobmeyer et. al., 1983	4
UE-25b#1	784				22.00	21.00				21.50	matrix	WTA	Bullfrog Member (crater Flat Tuff)	Lobmeyer et. al., 1983	4
UE-25b#1	814				22.00	22.00				22.00	matrix	WTA	Bullfrog Member (crater Flat Tuff)	Lobmeyer et. al., 1983	4
UE-25b#1	844				23.00	23.00				23.00	matrix	WTA	Bullfrog Member (crater Flat Tuff)	Lobmeyer et. al., 1983	4
UE-25b#1	924				20.00	19.00				19.50	matrix	WTA	Tram Member (crater Flat Tuff)	Lobmeyer et. al., 1983	4
UE-25b#1	949				18.00	19.00				18.50	matrix	WTA	Tram Member (crater Flat Tuff)	Lobmeyer et. al., 1983	4
UE-25b#1	1141				15.00	15.00				15.00	matrix	WTA	Tram Member (crater Flat Tuff)	Lobmeyer et. al., 1983	4
UE-25b#1	1171				12.00	13.00				12.50	matrix	WTA	Tram Member (crater Flat Tuff)	Lobmeyer et. al., 1983	4
UE-25b#1	1202				11.00	11.00				11.00	matrix	WTA	Tram Member (crater Flat Tuff)	Lobmeyer et. al., 1983	4
USW GU-3/G3	16.5				9.00					9.00	matrix	WTA	Tiva Canyon Member	Anderson, 1984	4
USW GU-3/G3	29.4				11.70					11.70	matrix	WTA	Tiva Canyon Member	Anderson, 1984	4
USW GU-3/G3	48.4				5.80					5.80	matrix	WTA	Tiva Canyon Member	Anderson, 1984	4
USW GU-3/G3	63.3				5.10					5.10	matrix	WTA	Tiva Canyon Member	Anderson, 1984	4
USW GU-3/G3	78.4				7.60					7.60	matrix	WTA	Tiva Canyon Member	Anderson, 1984	4
USW GU-3/G3	93.2				7.90					7.90	matrix	WTA	Tiva Canyon Member	Anderson, 1984	4
USW GU-3/G3	113.1				38.80					38.80	matrix	WTA	Bedded Tuff	Anderson, 1984	4
USW GU-3/G3	132.7				17.30					17.30	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW GU-3/G3	140.6				18.20					18.20	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW GU-3/G3	168.4				14.20					14.20	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW GU-3/G3	175.6				17.30					17.30	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW GU-3/G3	186.1				14.30					14.30	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW GU-3/G3	201.3				17.20					17.20	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW GU-3/G3	217.6				9.00					9.00	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW GU-3/G3	233.2				13.40					13.40	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW GU-3/G3	251.7				6.80					6.80	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW GU-3/G3	269.5				10.20					10.20	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW GU-3/G3	282.0				11.20					11.20	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW GU-3/G3	292.0				10.40					10.40	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW GU-3/G3	321.9				9.80					9.80	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW GU-3/G3	338.1				8.30					8.30	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW GU-3/G3	355.5				8.50					8.50	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW GU-3/G3	369.9				1.40					1.40	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW GU-3/G3	384.7				3.10					3.10	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW GU-3/G3	399.7				28.70					28.70	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW GU-3/G3	450.4				36.90					36.90	matrix	WTA	Calico Hills Tuff	Anderson, 1984	4
USW GU-3/G3	457.9				34.30					34.30	matrix	WTA	Calico Hills Tuff	Anderson, 1984	4
USW GU-3/G3	477.4				43.60					43.60	matrix	WTA	Bedded Tuff	Anderson, 1984	4
USW GU-3/G3	499.3				35.70					35.70	matrix	WTA	Prow Pass Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	508.1				31.60					31.60	matrix	WTA	Prow Pass Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	520.3				26.60					26.60	matrix	WTA	Prow Pass Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	542.6				39.70					39.70	matrix	WTA	Prow Pass Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	552.9				36.10					36.10	matrix	WTA	Prow Pass Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	569.2				29.10					29.10	matrix	WTA	Prow Pass Member of Crater Flat Tuff	Anderson, 1984	4

**Appendix A
Porosity Data Set**

Well Name	Sample Depth (m)	n(E,D)	n(C,D)	n(N,D)	n(C)	n(D)	n(V)	n(N)	n(R)	Average Porosity	Porosity Type	HSU	Stratigraphic Unit	Reference	DDE-F
USW GU-3/G3	583.1				30.50					30.50	matrix	WTA	Prow Pass Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	597.1				34.30					34.30	matrix	WTA	Prow Pass Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	612.3				30.00					30.00	matrix	WTA	Prow Pass Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	632.6				29.90					29.90	matrix	WTA	Bedded Tuff	Anderson, 1984	4
USW GU-3/G3	643.3				13.40					13.40	matrix	WTA	Bullfrog Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	660.8				17.70					17.70	matrix	WTA	Bullfrog Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	672.2				8.50					8.50	matrix	WTA	Bullfrog Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	688.0				8.40					8.40	matrix	WTA	Bullfrog Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	705.8				8.40					8.40	matrix	WTA	Bullfrog Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	718.5				7.00					7.00	matrix	WTA	Bullfrog Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	733.9				7.10					7.10	matrix	WTA	Bullfrog Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	752.6				5.80					5.80	matrix	WTA	Bullfrog Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	768.8				10.10					10.10	matrix	WTA	Bullfrog Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	781.2				26.90					26.90	matrix	WTA	Bedded Tuff	Anderson, 1984	4
USW GU-3/G3	798.0				21.70					21.70	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	811.1				31.10					31.10	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	832.6				30.70					30.70	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	845.0				27.70					27.70	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	859.1				25.80					25.80	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	874.5				24.30					24.30	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	888.3				18.00					18.00	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	910.4				16.70					16.70	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	915.9				14.80					14.80	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	933.5				13.90					13.90	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	949.8				12.80					12.80	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	963.3				15.90					15.90	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	986.3				6.00					6.00	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	993.7				1.80					1.80	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	1009.4				24.40					24.40	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	1024.5				22.70					22.70	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	1040.0				22.30					22.30	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	1056.1				21.80					21.80	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	1070.5				20.60					20.60	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	1085.4				20.50					20.50	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	1101.0				16.20					16.20	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	1115.6				16.60					16.60	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	1131.1				14.40					14.40	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	1165.5				10.90					10.90	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW GU-3/G3	1177.2				17.20					17.20	matrix	VCU	Bedded Tuff	Anderson, 1984	4
USW GU-3/G3	1192.8				19.50					19.50	matrix	VCU	Lithic Ridge Tuff	Anderson, 1984	4
USW GU-3/G3	1207.5				14.40					14.40	matrix	VCU	Lithic Ridge Tuff	Anderson, 1984	4
USW GU-3/G3	1222.2				21.40					21.40	matrix	VCU	Lithic Ridge Tuff	Anderson, 1984	4
USW GU-3/G3	1237.4				23.30					23.30	matrix	VCU	Lithic Ridge Tuff	Anderson, 1984	4
USW GU-3/G3	1253.2				17.00					17.00	matrix	VCU	Lithic Ridge Tuff	Anderson, 1984	4
USW GU-3/G3	1268.0				16.90					16.90	matrix	VCU	Lithic Ridge Tuff	Anderson, 1984	4
USW GU-3/G3	1283.4				15.60					15.60	matrix	VCU	Lithic Ridge Tuff	Anderson, 1984	4
USW GU-3/G3	1299.1				23.50					23.50	matrix	VCU	Lithic Ridge Tuff	Anderson, 1984	4
USW GU-3/G3	1314.6				18.00					18.00	matrix	VCU	Lithic Ridge Tuff	Anderson, 1984	4
USW GU-3/G3	1329.6				11.60					11.60	matrix	VCU	Lithic Ridge Tuff	Anderson, 1984	4
USW GU-3/G3	1344.5				15.00					15.00	matrix	VCU	Lithic Ridge Tuff	Anderson, 1984	4
USW GU-3/G3	1360.1				9.20					9.20	matrix	VCU	Lithic Ridge Tuff	Anderson, 1984	4
USW GU-3/G3	1375.2				14.70					14.70	matrix	VCU	Lithic Ridge Tuff	Anderson, 1984	4
USW GU-3/G3	1392.6				10.60					10.60	matrix	VCU	Lithic Ridge Tuff	Anderson, 1984	4
USW GU-3/G3	1405.4				13.00					13.00	matrix	VCU	Lithic Ridge Tuff	Anderson, 1984	4
USW GU-3/G3	1420.7				16.10					16.10	matrix	VCU	Lithic Ridge Tuff	Anderson, 1984	4
USW GU-3/G3	1435.3				15.30					15.30	matrix	VCU	Lithic Ridge Tuff	Anderson, 1984	4
USW GU-3/G3	1450.0				17.90					17.90	matrix	VCU	Lithic Ridge Tuff	Anderson, 1984	4
USW GU-3/G3	1469.1				19.30					19.30	matrix	VCU	Lithic Ridge Tuff	Anderson, 1984	4
USW GU-3/G3	1482.0				17.50					17.50	matrix	VCU	Bedded Tuff	Anderson, 1984	4
USW GU-3/G3	1497.2				14.60					14.60	matrix	VCU	Older Tuffs	Anderson, 1984	4
USW GU-3/G3	1517.7				13.80					13.80	matrix	VCU	Older Tuffs	Anderson, 1984	4
USW GU-3/G3	1527.4				12.60					12.60	matrix	VCU	Older Tuffs	Anderson, 1984	4
USW G-4	18.0				5.50					5.50	matrix	WTA	Tiva Canyon Member	Anderson, 1984	4
USW G-4	27.7				8.00					8.00	matrix	WTA	Tiva Canyon Member	Anderson, 1984	4
USW G-4	51.7				51.90					51.90	matrix	WTA	Pah Canyon Member	Anderson, 1984	4
USW G-4	85.5				13.00					13.00	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW G-4	101.3				15.70					15.70	matrix	WTA	Topopah Spring Member	Anderson, 1984	4

**Appendix A
Porosity Data Set**

Well Name	Sample Depth (m)	n(E,D)	n(C,D)	n(N,D)	n(C)	n(D)	n(V)	n(N)	n(R)	Average Porosity	Porosity Type	HSU	Stratigraphic Unit	Reference	DDE-F
USW G-4	119.0				12.90					12.90	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW G-4	167.2				20.30					20.30	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW G-4	183.7				16.80					16.80	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW G-4	203.8				11.90					11.90	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW G-4	226.4				7.40					7.40	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW G-4	250.4				11.50					11.50	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW G-4	266.9				9.90					9.90	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW G-4	285.9				10.80					10.80	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW G-4	324.5				13.80					13.80	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW G-4	377.8				9.40					9.40	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW G-4	415.1				16.90					16.90	matrix	WTA	Topopah Spring Member	Anderson, 1984	4
USW G-4	436.4				36.60					36.60	matrix	WTA	Calico Hills Tuff	Anderson, 1984	4
USW G-4	447.6				32.10					32.10	matrix	WTA	Calico Hills Tuff	Anderson, 1984	4
USW G-4	460.8				31.80					31.80	matrix	WTA	Calico Hills Tuff	Anderson, 1984	4
USW G-4	478.8				35.80					35.80	matrix	WTA	Calico Hills Tuff	Anderson, 1984	4
USW G-4	496.1				32.60					32.60	matrix	WTA	Calico Hills Tuff	Anderson, 1984	4
USW G-4	511.7				34.30					34.30	matrix	WTA	Calico Hills Tuff	Anderson, 1984	4
USW G-4	544.0				29.70					29.70	matrix	WTA	Prow Pass Member of Crater Flat Tuff	Anderson, 1984	4
USW G-4	555.7				34.60					34.60	matrix	WTA	Prow Pass Member of Crater Flat Tuff	Anderson, 1984	4
USW G-4	570.3				29.80					29.80	matrix	WTA	Prow Pass Member of Crater Flat Tuff	Anderson, 1984	4
USW G-4	584.1				19.40					19.40	matrix	WTA	Prow Pass Member of Crater Flat Tuff	Anderson, 1984	4
USW G-4	602.4				32.50					32.50	matrix	WTA	Prow Pass Member of Crater Flat Tuff	Anderson, 1984	4
USW G-4	619.6				35.00					35.00	matrix	WTA	Prow Pass Member of Crater Flat Tuff	Anderson, 1984	4
USW G-4	632.0				20.60					20.60	matrix	WTA	Prow Pass Member of Crater Flat Tuff	Anderson, 1984	4
USW G-4	649.8				24.30					24.30	matrix	WTA	Prow Pass Member of Crater Flat Tuff	Anderson, 1984	4
USW G-4	665.2				29.20					29.20	matrix	WTA	Prow Pass Member of Crater Flat Tuff	Anderson, 1984	4
USW G-4	679.4				28.60					28.60	matrix	WTA	Prow Pass Member of Crater Flat Tuff	Anderson, 1984	4
USW G-4	700.6				24.80					24.80	matrix	WTA	Bullfrog Member of Crater Flat Tuff	Anderson, 1984	4
USW G-4	712.4				24.40					24.40	matrix	WTA	Bullfrog Member of Crater Flat Tuff	Anderson, 1984	4
USW G-4	726.1				20.80					20.80	matrix	WTA	Bullfrog Member of Crater Flat Tuff	Anderson, 1984	4
USW G-4	742.7				25.70					25.70	matrix	WTA	Bullfrog Member of Crater Flat Tuff	Anderson, 1984	4
USW G-4	755.5				25.00					25.00	matrix	WTA	Bullfrog Member of Crater Flat Tuff	Anderson, 1984	4
USW G-4	769.4				21.90					21.90	matrix	WTA	Bullfrog Member of Crater Flat Tuff	Anderson, 1984	4
USW G-4	785.9				18.20					18.20	matrix	WTA	Bullfrog Member of Crater Flat Tuff	Anderson, 1984	4
USW G-4	804.1				11.30					11.30	matrix	WTA	Bullfrog Member of Crater Flat Tuff	Anderson, 1984	4
USW G-4	821.5				28.00					28.00	matrix	WTA	Bullfrog Member of Crater Flat Tuff	Anderson, 1984	4
USW G-4	829.1				24.70					24.70	matrix	WTA	Bullfrog Member of Crater Flat Tuff	Anderson, 1984	4
USW G-4	861.7				27.60					27.60	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW G-4	871.0				19.60					19.60	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW G-4	895.9				18.90					18.90	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
USW G-4	908.5				15.20					15.20	matrix	WTA	Tram Member of Crater Flat Tuff	Anderson, 1984	4
UE25a-4	46.8				41.20					41.20	matrix	WTA	Yucca Mountain Member of Paintbrush Tuff	Anderson, 1991	4
UE25a-4	102.8				7.10					7.10	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-4	111.6				19.10					19.10	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-4	120.0				11.60					11.60	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-4	127.3				14.10					14.10	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-4	136.3				13.40					13.40	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-4	143.3				12.90					12.90	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-4	150.1				9.90					9.90	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-5	41.4				42.20					42.20	matrix	WTA	Tiva Canyon Member	Anderson, 1991	4
UE25a-5	85.8				2.90					2.90	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-5	93.1				4.20					4.20	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-5	102.3				11.40					11.40	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-5	109.3				16.20					16.20	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-5	116.8				13.60					13.60	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-5	124.9				13.20					13.20	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-5	134.1				12.80					12.80	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-5	142.0				18.40					18.40	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-5	146.4				12.10					12.10	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-6	32.7				10.50					10.50	matrix	WTA	Tiva Canyon Member	Anderson, 1991	4
UE25a-6	39.3				28.90					28.90	matrix	WTA	Tiva Canyon Member	Anderson, 1991	4
UE25a-6	94.9				15.00					15.00	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-6	104.9				16.00					16.00	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-6	112.4				12.80					12.80	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-6	121.0				14.40					14.40	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-6	132.9				14.20					14.20	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-7	53.5				42.80					42.80	matrix	WTA	Tiva Canyon Member	Anderson, 1991	4

Appendix A
Porosity Data Set

Well Name	Sample Depth (m)	n(E,D)	n(C,D)	n(N,D)	n(C)	n(D)	n(V)	n(N)	n(R)	Average Porosity	Porosity Type	HSU	Stratigraphic Unit	Reference	DDE-F
UE25a-7	59.6				55.50					55.50	matrix	WTA	Yucca Mountain Member of Paintbrush Tuff	Anderson, 1991	4
UE25a-7	71.3				43.10					43.10	matrix	WTA	Pah Canyon Member of Paintbrush Tuff	Anderson, 1991	4
UE25a-7	95.2				1.60					1.60	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-7	102.1				9.90					9.90	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-7	114.4				15.50					15.50	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-7	120.8				16.50					16.50	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-7	132.4				13.50					13.50	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-7	138.3				14.20					14.20	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25a-7	144.7				14.00					14.00	matrix	WTA	Topopah Spring Member	Anderson, 1991	4
UE25p#1	1052.7				17.90					17.90	matrix	VCU	Lithic Ridge Tuff	Anderson, 1991	4
UE25p#1	1194.2				15.80					15.80	matrix	VCU	Calcified Tuff	Anderson, 1991	4
UE25p#1	1282.8				4.10					4.10	matrix	LCA	Lone Mt. Dolomite	Anderson, 1991	4
UE25p#1	1303.2				5.20					5.20	matrix	LCA	Lone Mt. Dolomite	Anderson, 1991	4
UE25p#1	1309.7				5.20					5.20	matrix	LCA	Lone Mt. Dolomite	Anderson, 1991	4
UE25p#1	1331.9				3.00					3.00	matrix	LCA	Lone Mt. Dolomite	Anderson, 1991	4
UE25p#1	1347.4				1.50					1.50	matrix	LCA	Lone Mt. Dolomite	Anderson, 1991	4
UE25p#1	1360.2				9.90					9.90	matrix	LCA	Lone Mt. Dolomite	Anderson, 1991	4
UE25p#1	1373.3				5.80					5.80	matrix	LCA	Lone Mt. Dolomite	Anderson, 1991	4
UE25p#1	1388.8				5.70					5.70	matrix	LCA	Lone Mt. Dolomite	Anderson, 1991	4
UE25p#1	1406.6				9.50					9.50	matrix	LCA	Lone Mt. Dolomite	Anderson, 1991	4
UE25p#1	1421.8				1.40					1.40	matrix	LCA	Lone Mt. Dolomite	Anderson, 1991	4
UE25p#1	1433.8				1.50					1.50	matrix	LCA	Lone Mt. Dolomite	Anderson, 1991	4
UE25p#1	1455.3				0.90					0.90	matrix	LCA	Lone Mt. Dolomite	Anderson, 1991	4
UE25p#1	1483.0				3.20					3.20	matrix	LCA	Lone Mt. Dolomite	Anderson, 1991	4
UE25p#1	1799.0				0.30					0.30	matrix	LCA	Roberts Mt. Fm.	Anderson, 1991	4
Well C	171.6				39.10					39.10	matrix	TCU1	Lower member of Oak Spring Formation	Garber and Thordarson, 1962	4
Well C	199.0				29.20					29.20	matrix	TCU1	Lower member of Oak Spring Formation	Garber and Thordarson, 1962	4
Well C	214.0				34.30					34.30	matrix	TCU1	Lower member of Oak Spring Formation	Garber and Thordarson, 1962	4
Well C	228.6-228.9				28.80					28.80	matrix	TCU1	Lower member of Oak Spring Formation	Garber and Thordarson, 1962	4
Well C	259.4-259.7				26.60					26.60	matrix	TCU1	Lower member of Oak Spring Formation	Garber and Thordarson, 1962	4
Well C	292.3-292.6				30.60					30.60	matrix	TCU1	Lower member of Oak Spring Formation	Garber and Thordarson, 1962	4
Well C	320.0				38.50					38.50	matrix	TCU1	Lower member of Oak Spring Formation	Garber and Thordarson, 1962	4
Well C	351.4				27.10					27.10	matrix	TCU1	Lower member of Oak Spring Formation	Garber and Thordarson, 1962	4
Well C	382.8				21.30					21.30	matrix	TCU1	Lower member of Oak Spring Formation	Garber and Thordarson, 1962	4
Well C	406.0				19.80					19.80	matrix	TCU1	Lower member of Oak Spring Formation	Garber and Thordarson, 1962	4
Well C	408.4				21.20					21.20	matrix	TCU1	Lower member of Oak Spring Formation	Garber and Thordarson, 1962	4
Test Well 8	45.7-91.4							>42			bulk	TBA	Grouse Canyon Member	Carroll, 1963	4
Test Well 8	91.4-112.8							39.00		39.00	bulk	TBA	Grouse Canyon Member	Carroll, 1963	4
Test Well 8	112.8-119.5							>42			bulk	TBA	Grouse Canyon Member	Carroll, 1963	4
Test Well 8	119.5-173.1							34.00		34.00	bulk	TBA	Grouse Canyon Member	Carroll, 1963	4
Test Well 8	173.1-209.1							>39			bulk	TBA	Grouse Canyon Member	Carroll, 1963	4
Test Well 8	209.1-242.6							33.00		33.00	bulk	TBA	Grouse Canyon Member	Carroll, 1963	4
Test Well 8	347.5-374.9						33			33	bulk	TBA	Zeolitized tuff	Carroll, 1963	4
Test Well 8	397.2-405.4						19			19	bulk	TBA	Rhyolite	Carroll, 1963	4
Test Well 8	423.7-438.9						20			20	bulk	TBA	Rhyolite	Carroll, 1963	4
Test Well 8	454.2-499.9						21			21	bulk	TBA	Rhyolite and partly welded tuff	Carroll, 1963	4
Test Well 8	1337.2				9.10					9.10	matrix	BAQ		Carroll, 1963	4
Test Well 8	1210.7				14.90					14.90	matrix	BAQ		Carroll, 1963	4
Test Well 8	1249.1				19.40					19.40	matrix	BAQ		Carroll, 1963	4
Test Well 8	1206.4				13.50					13.50	matrix	BAQ		Carroll, 1963	4
Test Well 8	1006.9				26.10					26.10	matrix	BAQ		Carroll, 1963	4
Test Well 8	696.5				26.30					26.30	matrix	BAQ		Carroll, 1963	4
Test Well 8	1481.6				13.50					13.50	matrix	BAQ		Carroll, 1963	4
Test Well 8	671.5				27.10					27.10	matrix	BAQ		Carroll, 1963	4
Test Well 8	810.2				21.20					21.20	matrix	BAQ		Carroll, 1963	4
Test Well 8	749.7				23.60					23.60	matrix	BAQ		Carroll, 1963	4
Test Well 8	621.8				26.30					26.30	matrix	BAQ		Carroll, 1963	4
Test Well 8	755.6				22.70					22.70	matrix	BAQ		Carroll, 1963	4
Test Well 8	919.3				14.40					14.40	matrix	BAQ		Carroll, 1963	4
Test Well 8	977.8				16.00					16.00	matrix	BAQ		Carroll, 1963	4
Test Well 8	1043.0				11.50					11.50	matrix	BAQ		Carroll, 1963	4
Test Well 8	878.9				17.50					17.50	matrix	BAQ		Carroll, 1963	4
Test Well 8	951.3				12.90					12.90	matrix	BAQ		Carroll, 1963	4
Test Well 8	1078.1				18.30					18.30	matrix	BAQ		Carroll, 1963	4
Test Well 8	1110.8				15.60					15.60	matrix	BAQ		Carroll, 1963	4
Test Well 8	780.3				19.80					19.80	matrix	BAQ		Carroll, 1963	4
Test Well 8	721.0				24.60					24.60	matrix	BAQ		Carroll, 1963	4

Appendix A
Porosity Data Set

Well Name	Sample Depth (m)	n(E,D)	n(C,D)	n(N,D)	n(C)	n(D)	n(V)	n(N)	n(R)	Average Porosity	Porosity Type	HSU	Stratigraphic Unit	Reference	DDE-F
Test Well 8	839.3				18.10					18.10	matrix	BAQ		Carroll, 1963	4
Test Well 8	1397.9									11.50	matrix	BAQ		Carroll, 1963	4
Test Well 8	1560.0				14.60					14.60	matrix	BAQ		Carroll, 1963	4
Test Well 8	873.3				22.10					22.10	matrix	BAQ		Carroll, 1963	4
Test Well 8	621.8-857.4						23			23.00	bulk	BAQ	Lower Member tuffs	Carroll, 1963	4
Test Well 8	857.4-941.8						18		18	18.00	bulk	BAQ	Indian Trail Formation	Carroll, 1963	4
Test Well 8	941.8-1062.8						13		16	14.50	bulk	BAQ	Indian Trail Formation	Carroll, 1963	4
Test Well 8	1062.8-1229.9						16			16.00	bulk	BAQ	Indian Trail Formation	Carroll, 1963	4
Test Well 8	1229.9-1261.9						16			16.00	bulk	BAQ	Indian Trail Formation	Carroll, 1963	4
Test Well 8	1261.9-1411.2						8		9	8.50	bulk	BAQ	Indian Trail Formation	Carroll, 1963	4
Test Well 8	1411.2-1542.3						12		12	12.00	bulk	BAQ	Indian Trail Formation	Carroll, 1963	4
Test Well 8	1542.3-1610.0						12			12.00	bulk	BAQ	Indian Trail Formation	Carroll, 1963	4
Test Well 8	1610.0-1630.7						9			9.00	bulk	BAQ	Basal conglomerate	Carroll, 1963	4
Well J-13	161.7				8.10					8.10	matrix	WTA	Tiva Canyon Member	Thordarson, 1983	4
Well J-13	203.1				54.40					54.40	matrix	WTA	Tiva Canyon Member	Thordarson, 1983	4
Well J-13	203.9				31.90					31.90	matrix	WTA	Tiva Canyon Member	Thordarson, 1983	4
Well J-13	241.5				16.70					16.70	matrix	WTA	Topopah Spring Member	Thordarson, 1983	4
Well J-13	263.7-268.2				16.20					16.20	matrix	WTA	Topopah Spring Member	Thordarson, 1983	4
Well J-13	278.9				11.00					11.00	matrix	WTA	Topopah Spring Member	Thordarson, 1983	4
Well J-13	310.9				13.10					13.10	matrix	WTA	Topopah Spring Member	Thordarson, 1983	4
Well J-13	333.4				27.90					27.90	matrix	WTA	Topopah Spring Member	Thordarson, 1983	4
Well J-13	360.8				16.00					16.00	matrix	WTA	Topopah Spring Member	Thordarson, 1983	4
Well J-13	391.2				12.30					12.30	matrix	WTA	Topopah Spring Member	Thordarson, 1983	4
Well J-13	406.0-407.2				3.70					3.70	matrix	WTA	Topopah Spring Member	Thordarson, 1983	4
Well J-13	429.0				11.60					11.60	matrix	WTA	Topopah Spring Member	Thordarson, 1983	4
Well J-13	440.6				32.70					32.70	matrix	WTA	Topopah Spring Member	Thordarson, 1983	4
Well J-13	459.9				29.90					29.90	matrix	WTA	Tuffaceous beds of Calico Hills	Thordarson, 1983	4
Well J-13	610.0				30.20					30.20	matrix	WTA	Prow Pass(?) Member	Thordarson, 1983	4
Well J-13	618.0				27.10					27.10	matrix	WTA	Bullfrog Member	Thordarson, 1983	4
Well J-13	648.6				27.60					27.60	matrix	WTA	Bullfrog Member	Thordarson, 1983	4
Well J-13	693.7				21.40					21.40	matrix	WTA	Bullfrog Member	Thordarson, 1983	4
Well J-13	724.5				27.20					27.20	matrix	WTA	Tram Member	Thordarson, 1983	4
Well J-13	815.3				20.30					20.30	matrix	WTA	Tram Member	Thordarson, 1983	4
Well J-13	862.9				16.50					16.50	matrix	WTA	Tram Member	Thordarson, 1983	4
Well J-13	911.0				26.00					26.00	matrix	WTA	Tram Member	Thordarson, 1983	4
Well J-13	1062.8				20.30					20.30	matrix	WTA	Tuff of Lithic Ridge	Thordarson, 1983	4
Well J-13	164.3				2.80					2.80	matrix	WTA	Tiva Canyon Member	Thordarson, 1983	4
Well J-13	205.7				5.20					5.20	matrix	WTA	Tiva Canyon Member	Thordarson, 1983	4
Well J-13	207.3				3.70					3.70	matrix	WTA	Tiva Canyon Member	Thordarson, 1983	4
Well J-13	244.1				2.70					2.70	matrix	WTA	Topopah Spring Member	Thordarson, 1983	4
Well J-13	335.3				8.70					8.70	matrix	WTA	Topopah Spring Member	Thordarson, 1983	4
Well J-13	363.6				6.80					6.80	matrix	WTA	Topopah Spring Member	Thordarson, 1983	4
Well J-13	409.0				5.40					5.40	matrix	WTA	Topopah Spring Member	Thordarson, 1983	4
Well J-13	431.6				3.30					3.30	matrix	WTA	Topopah Spring Member	Thordarson, 1983	4
USW H-1	33.5			*45		**42					matrix	WTA	Yucca Mountain Member	Rush et al., 1983	5
USW H-1	34.1				43.00					43.00	matrix	WTA	Yucca Mountain Member	Rush et al., 1983	5
USW H-1	76.9				48.00					48.00	matrix	WTA	Pah Canyon Member	Rush et al., 1983	5
USW H-1	128.0				22.00	20.00				21.00	matrix	WTA	Topopah Spring Member	Rush et al., 1983	5
USW H-1	129.0				24.00	19.00				21.50	matrix	WTA	Topopah Spring Member	Rush et al., 1983	5
USW H-1	135.0				21.00	20.00				20.50	matrix	WTA	Topopah Spring Member	Rush et al., 1983	5
USW H-1	137.0				19.00	17.00				18.00	matrix	WTA	Topopah Spring Member	Rush et al., 1983	5
USW H-1	140.0				16.00					16.00	matrix	WTA	Topopah Spring Member	Rush et al., 1983	5
USW H-1	141.0				17.00					17.00	matrix	WTA	Topopah Spring Member	Rush et al., 1983	5
USW H-1	142.0				17.00	15.00				16.00	matrix	WTA	Topopah Spring Member	Rush et al., 1983	5
USW H-1	143.0				15.00	13.00				14.00	matrix	WTA	Topopah Spring Member	Rush et al., 1983	5
USW H-1	219.0				17.00	15.00				16.00	matrix	WTA	Topopah Spring Member	Rush et al., 1983	5
USW H-1	221.0				28.00	17.00				22.50	matrix	WTA	Topopah Spring Member	Rush et al., 1983	5
USW H-1	222.0				18.00	13.00				15.50	matrix	WTA	Topopah Spring Member	Rush et al., 1983	5
USW H-1	226.0					16.00				16.00	matrix	WTA	Topopah Spring Member	Rush et al., 1983	5
USW H-1	390.0				16.00	15.00				15.50	matrix	WTA	Topopah Spring Member	Rush et al., 1983	5
USW H-1	391.0				16.00	13.00				14.50	matrix	WTA	Topopah Spring Member	Rush et al., 1983	5
USW H-1	398.0				14.00	11.00				12.50	matrix	WTA	Topopah Spring Member	Rush et al., 1983	5
USW H-1	399.0				10.00	10.00				10.00	matrix	WTA	Topopah Spring Member	Rush et al., 1983	5
USW H-1	405.0				12.00	12.00				12.00	matrix	WTA	Topopah Spring Member	Rush et al., 1983	5
USW H-1	406.0				11.00	7.90				9.45	matrix	WTA	Topopah Spring Member	Rush et al., 1983	5
USW H-1	531.0				47.00	43.00				45.00	matrix	WTA	Tuffaceous Beds of Calico Hills	Rush et al., 1983	5
USW H-1	533.0				44.00	37.00				40.50	matrix	WTA	Tuffaceous Beds of Calico Hills	Rush et al., 1983	5

**Appendix A
Porosity Data Set**

Well Name	Sample Depth (m)	n(E,D)	n(C,D)	n(N,D)	n(C)	n(D)	n(V)	n(N)	n(R)	Average Porosity	Porosity Type	HSU	Stratigraphic Unit	Reference	DDE-F
USW H-1	640.0				33.00	28.00				30.50	matrix	WTA	Prow Pass Member	Rush et al., 1983	5
USW H-1	641.0				31.00	29.00				30.00	matrix	WTA	Prow Pass Member	Rush et al., 1983	5
USW H-1	641.0				32.00	29.00				30.50	matrix	WTA	Prow Pass Member	Rush et al., 1983	5
USW H-1	709.0				33.00	27.00				30.00	matrix	WTA	Bullfrog Member	Rush et al., 1983	5
USW H-1	709.0				33.00	32.00				32.50	matrix	WTA	Bullfrog Member	Rush et al., 1983	5
USW H-1	710.0				38.00	34.00				36.00	matrix	WTA	Bullfrog Member	Rush et al., 1983	5
USW H-1	713.0				19.00	20.00				19.50	matrix	WTA	Bullfrog Member	Rush et al., 1983	5
USW H-1	764.0				28.00					28.00	matrix	WTA	Bullfrog Member	Rush et al., 1983	5
USW H-1	772.0				25.00	25.00				25.00	matrix	WTA	Bullfrog Member	Rush et al., 1983	5
USW H-1	790.0				19.00	19.00				19.00	matrix	WTA	Bullfrog Member	Rush et al., 1983	5
USW H-1	791.0				19.00	20.00				19.50	matrix	WTA	Bullfrog Member	Rush et al., 1983	5
USW H-1	792.0				21.00	22.00				21.50	matrix	WTA	Bullfrog Member	Rush et al., 1983	5
USW H-1	830.0				27.00	25.00				26.00	matrix	WTA	Bullfrog Member	Rush et al., 1983	5
USW H-1	833.0				28.00	26.00				27.00	matrix	WTA	Tram Member	Rush et al., 1983	5
USW H-1	840.0				26.00	26.00				26.00	matrix	WTA	Tram Member	Rush et al., 1983	5
USW H-1	844.0				24.00	21.00				22.50	matrix	WTA	Tram Member	Rush et al., 1983	5
USW H-1	1031.0				25.00	21.00				23.00	matrix	WTA	Tram Member	Rush et al., 1983	5
USW H-1	1031.0				23.00	23.00				23.00	matrix	WTA	Tram Member	Rush et al., 1983	5
USW H-1	1032.0				26.00	22.00				24.00	matrix	WTA	Tram Member	Rush et al., 1983	5
USW H-1	1039.0				18.00	18.00				18.00	matrix	WTA	Tram Member	Rush et al., 1983	5
USW H-1	1039.0				19.00	18.00				18.50	matrix	WTA	Tram Member	Rush et al., 1983	5
USW H-1	1040.0				22.00	21.00				21.50	matrix	WTA	Tram Member	Rush et al., 1983	5
USW H-1	1201.0				7.00	7.30				7.15	matrix	WTA	Flow Breccia	Rush et al., 1983	5
USW H-1	1569.0				16.00	17.00				16.50	matrix	VCU	Older ash-flow and bedded tuff	Rush et al., 1983	5
USW H-1	1820.0				10.00	8.80				9.40	matrix	VCU	Older ash-flow and bedded tuff	Rush et al., 1983	5
U12e.03a					38.80					38.80	matrix	BCU	Tunnel Bed 3 (Subunit D)	Emerick, Dickey, and Bunker, 1963	4
U12e.03a					33.20					33.20	matrix	BCU	Tunnel Bed 3 (Subunit D)	Emerick, Dickey, and Bunker, 1963	4
U12e.03a					36.40					36.40	matrix	BCU	Tunnel Bed 3 (Subunit D)	Emerick, Dickey, and Bunker, 1963	4
U12e.03a					33.40					33.40	matrix	BCU	Tunnel Bed 3 (Subunit D)	Emerick, Dickey, and Bunker, 1963	4
U12e.03b					45.20					45.20	matrix	BCU	Tunnel Bed 3 (Subunit D)	Emerick, Dickey, and Bunker, 1963	4
U12e.03b					37.10					37.10	matrix	BCU	Tunnel Bed 3 (Subunit D)	Emerick, Dickey, and Bunker, 1963	4
U12e.03b					40.30					40.30	matrix	BCU	Tunnel Bed 3 (Subunit D)	Emerick, Dickey, and Bunker, 1963	4
U12e.03b					35.30					35.30	matrix	BCU	Tunnel Bed 3 (Subunit D)	Emerick, Dickey, and Bunker, 1963	4
U12e.03a					40.60					40.60	matrix	BCU	Tunnel Bed 4 (Subunit A)	Emerick, Dickey, and Bunker, 1963	4
U12e.03a					38.40					38.40	matrix	BCU	Tunnel Bed 4 (Subunit A)	Emerick, Dickey, and Bunker, 1963	4
U12e.03a					43.80					43.80	matrix	BCU	Tunnel Bed 4 (Subunit A)	Emerick, Dickey, and Bunker, 1963	4
U12e.03a					42.80					42.80	matrix	BCU	Tunnel Bed 4 (Subunit A)	Emerick, Dickey, and Bunker, 1963	4
U12e.03b					40.70					40.70	matrix	BCU	Tunnel Bed 4 (Subunit A)	Emerick, Dickey, and Bunker, 1963	4
U12e.03b					35.00					35.00	matrix	BCU	Tunnel Bed 4 (Subunit A)	Emerick, Dickey, and Bunker, 1963	4
U12e.03b					36.10					36.10	matrix	BCU	Tunnel Bed 4 (Subunit A)	Emerick, Dickey, and Bunker, 1963	4
U12e.03b					35.50					35.50	matrix	BCU	Tunnel Bed 4 (Subunit A)	Emerick, Dickey, and Bunker, 1963	4
Test Well F	80.8				30.10					30.10	matrix	WLA	Wahmonie Formation	Carroll, 1963	4
Test Well F	105.2				33.50					33.50	matrix	WLA	Wahmonie Formation	Carroll, 1963	4
Test Well F	174.0				29.30					29.30	matrix	WLA	Wahmonie Formation	Carroll, 1963	4
Test Well F	187.5				23.50					23.50	matrix	WLA	Wahmonie Formation	Carroll, 1963	4
Test Well F	217.9				27.00					27.00	matrix	WLA	Wahmonie Formation	Carroll, 1963	4
Test Well F	219.5				32.30					32.30	matrix	WLA	Wahmonie Formation	Carroll, 1963	4
Test Well F	245.7				22.80					22.80	matrix	WLA	Wahmonie Formation	Carroll, 1963	4
Test Well F	260.3				25.00					25.00	matrix	WLA	Wahmonie Formation	Carroll, 1963	4
Test Well F	290.5				27.70					27.70	matrix	WLA	Wahmonie Formation	Carroll, 1963	4
Test Well F	306.0				31.50					31.50	matrix	WLA	Wahmonie Formation	Carroll, 1963	4
Test Well F	323.1				22.30					22.30	matrix	WLA	Wahmonie Formation	Carroll, 1963	4
Test Well F	324.3				26.40					26.40	matrix	WLA	Wahmonie Formation	Carroll, 1963	4
Test Well F	335.9				24.60					24.60	matrix	WLA	Wahmonie Formation	Carroll, 1963	4
Test Well F	642.2				*17.4	**16		***12.5	****10.71		bulk	WLA	Pavits Spring Formation	Carroll, 1963	4
Test Well F	667.8				16.90	17	16.5	8.67		14.77	bulk	WLA	Pavits Spring Formation	Carroll, 1963	4
Test Well F	690.4				19.80	21.5	15.5	7.39		16.05	bulk	WLA	Pavits Spring Formation	Carroll, 1963	4
Test Well F	720.5				16.80	18		7.27		14.02	bulk	WLA	Pavits Spring Formation	Carroll, 1963	4
Test Well F	756.2				22.00	24	16.5	12.10		18.65	bulk	WLA	Pavits Spring Formation	Carroll, 1963	4
Test Well F	613.3				18.10	16	14.5	12.74		15.34	bulk	WLA	Pavits Spring Formation	Carroll, 1963	4
Test Well F	617.5				19.10	25	11.5	12.90		17.13	bulk	WLA	Pavits Spring Formation	Carroll, 1963	4
UE25a-3	65.9				4.40					4.40	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	107.9				8.20					8.20	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	196.0				9.80					9.80	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	203.0				7.30					7.30	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	206.1				11.80					11.80	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	217.4				7.50					7.50	matrix	UCCU	Eleana Formation	Anderson, 1981	4

**Appendix A
Porosity Data Set**

Well Name	Sample Depth (m)	n(E,D)	n(C,D)	n(N,D)	n(C)	n(D)	n(V)	n(N)	n(R)	Average Porosity	Porosity Type	HSU	Stratigraphic Unit	Reference	DDE-F
UE25a-3	229.6				9.00					9.00	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	264.0				6.20					6.20	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	284.2				11.30					11.30	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	390.9				9.10					9.10	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	401.5				11.50					11.50	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	424.7				5.00					5.00	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	435.1				11.70					11.70	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	441.5				11.50					11.50	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	462.8				9.80					9.80	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	473.5				5.80					5.80	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	487.2				11.40					11.40	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	502.7				2.30					2.30	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	510.7				13.90					13.90	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	524.7				4.90					4.90	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	529.3				17.20					17.20	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	554.9				10.80					10.80	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	599.7				6.60					6.60	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	612.5				4.40					4.40	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	632.9				10.90					10.90	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	647.9				22.60					22.60	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	655.5				7.50					7.50	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	683.2				10.10					10.10	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	714.0				5.80					5.80	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	722.9				1.30					1.30	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	725.6				16.20					16.20	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	733.5				2.60					2.60	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	751.5				2.60					2.60	matrix	UCCU	Eleana Formation	Anderson, 1981	4
UE25a-3	769.2				7.60					7.60	matrix	UCCU	Eleana Formation	Anderson, 1981	4
Water Well 2	900.7-906.5			11.00						11.00	bulk	LCA	Pogonip Group fractured dolomite	IT Corp., 1993	5
Water Well 2	986.0-988.2			12.00						12.00	bulk	LCA	Pogonip Group fractured dolomite	IT Corp., 1993	5
Water Well 2	1033.9-1004.9			12.00						12.00	bulk	LCA	Pogonip Group fractured dolomite	IT Corp., 1993	5
Water Well 2	900.7-906.5							2		2	matrix	LCA	Pogonip Group fractured dolomite	IT Corp., 1993	5
Water Well 2	986.0-988.2							4		4	matrix	LCA	Pogonip Group fractured dolomite	IT Corp., 1993	5
Water Well 2	1033.9-1004.9							2		2	matrix	LCA	Pogonip Group fractured dolomite	IT Corp., 1993	5
Water Well 2	900.7-906.5							9		9	fracture	LCA	Pogonip Group fractured dolomite	IT Corp., 1993	5
Water Well 2	986.0-988.2							8		8	fracture	LCA	Pogonip Group fractured dolomite	IT Corp., 1993	5
Water Well 2	1033.9-1004.9							10		10	fracture	LCA	Pogonip Group fractured dolomite	IT Corp., 1993	5
U2-j2	32.6				29.40					29.40	matrix	AA	Alluvium	Williams et al., 1963	4
U2-j2	38.6				30.20					30.20	matrix	AA	Alluvium	Williams et al., 1963	4
U2-j2	45.7				16.20					16.20	matrix	AA	Alluvium	Williams et al., 1963	4
U2-j2	77.4-77.8				25.20					25.20	matrix	AA	Alluvium	Williams et al., 1963	4
U2-j2	107.7				24.00					24.00	matrix	AA	Alluvium	Williams et al., 1963	4
U2-j2	110.6				28.50					28.50	matrix	AA	Alluvium	Williams et al., 1963	4
U2-j2	122.0				20.80					20.80	matrix	AA	Alluvium	Williams et al., 1963	4
U2-j2	137.7-137.9				18.60					18.60	matrix	AA	Alluvium	Williams et al., 1963	4
U2-j2	137.9-138.0				28.50					28.50	matrix	AA	Alluvium	Williams et al., 1963	4
U2-j2	152.7-152.9				24.70					24.70	matrix	AA	Alluvium	Williams et al., 1963	4
U2-j2	168.6-168.6				28.00					28.00	matrix	AA	Alluvium	Williams et al., 1963	4
U2-j2	198.2				27.10					27.10	matrix	WTA	?	Williams et al., 1963	4
U2-j2	199.3				23.60					23.60	matrix	WTA	?	Williams et al., 1963	4
U2-j2	229.2-229.8				25.00					25.00	matrix	VTA	Caliche	Williams et al., 1963	4
U2-j2	91.6-93.0				13.40					13.40	matrix	AA	Tuff	Williams et al., 1963	4
U2-j2	121.9-122.5				25.60					25.60	matrix	AA	Tuff	Williams et al., 1963	4
U2j shaft	17.4-17.7				25.45					25.45	matrix	AA	Alluvium	Williams et al., 1963	4
U2j shaft	26.2-26.8				38.60					38.60	matrix	AA	Alluvium	Williams et al., 1963	4
U2j shaft	27.4-28.7				24.30					24.30	matrix	AA	Alluvium	Williams et al., 1963	4
U2j shaft	113.1				28.10					28.10	matrix	AA	Alluvium	Williams et al., 1963	4
U2j shaft	146.0				23.40					23.40	matrix	AA	Alluvium	Williams et al., 1963	4
UE4a	267.9				29.70					29.70	matrix	VTA	Piapi Canyon Fm.	Williams et al., 1963	4
UE4a	270.7				42.20					42.20	matrix	VTA	Piapi Canyon Fm.	Williams et al., 1963	4
UE4a	284.7				42.70					42.70	matrix	VTA	Piapi Canyon Fm.	Williams et al., 1963	4
UE4a	291.7				19.90					19.90	matrix	VTA	Piapi Canyon Fm.	Williams et al., 1963	4
UE4a	302.1				22.00					22.00	matrix	VTA	Piapi Canyon Fm.	Williams et al., 1963	4
UE4a	317.0				20.10					20.10	matrix	VTA	Piapi Canyon Fm.	Williams et al., 1963	4
UE4a	328.3				42.20					42.20	matrix	VTA	Piapi Canyon Fm.	Williams et al., 1963	4
UE4a	350.8				44.00					44.00	matrix	VTA	Piapi Canyon Fm.	Williams et al., 1963	4
UE4a	362.4				41.00					41.00	matrix	VTA	Piapi Canyon Fm.	Williams et al., 1963	4

Appendix A
Porosity Data Set

Well Name	Sample Depth (m)	n(E,D)	n(C,D)	n(N,D)	n(C)	n(D)	n(V)	n(N)	n(R)	Average Porosity	Porosity Type	HSU	Stratigraphic Unit	Reference	DDE-F
UE4a	363.3				41.00					41.00	matrix	VTa	Piapi Canyon Fm.	Williams et al., 1963	4
UE4a	411.5				30.10					30.10	matrix	VTa	Piapi Canyon Fm.	Williams et al., 1963	4
UE4a	422.1-422.5				22.30					22.30	matrix	VTa	Piapi Canyon Fm.	Williams et al., 1963	4
UE4a	432.5				43.30					43.30	matrix	VTa	Piapi Canyon Fm.	Williams et al., 1963	4
UE4a	450.2				39.10					39.10	matrix	VTa	Piapi Canyon Fm.	Williams et al., 1963	4
UE4a	474.0				33.80					33.80	matrix	VTa	Piapi Canyon Fm.	Williams et al., 1963	4
UE4a	556.3				41.00					41.00	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	568.8				33.90					33.90	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	572.4				42.50					42.50	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	580.0				36.00					36.00	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	596.5				34.00					34.00	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	621.5				36.10					36.10	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	629.1				31.40					31.40	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	705.1-705.6				23.80					23.80	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	712.9-713.1				32.90					32.90	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	717.3-717.6				24.80					24.80	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	720.4-720.5				32.50					32.50	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	722.4-722.5				27.70					27.70	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	736.7-736.8				33.90					33.90	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	747.5-747.7				26.40					26.40	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	751.5-751.7				24.50					24.50	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	756.3-756.5				29.30					29.30	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	771.5-771.7				30.80					30.80	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	787.5-787.8				20.30					20.30	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	791.4-791.5				24.30					24.30	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	799.1-799.3				22.00					22.00	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	806.0-806.1				23.10					23.10	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	813.3-813.8				21.80					21.80	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	819.6-819.7				19.80					19.80	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	822.5-822.7				28.20					28.20	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	830.9-831.1				23.20					23.20	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	842.1-842.3				13.70					13.70	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	844.3-847.8				21.40					21.40	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	865.5-865.8				28.10					28.10	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	876.8-877.0				21.50					21.50	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	879.7-879.8				29.60					29.60	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	880.9-881.1				16.50					16.50	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	890.0-890.2				10.60					10.60	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	894.9-903.1				20.50					20.50	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	910.1-910.4				18.60					18.60	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	911.4-912.3				23.20					23.20	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	912.0-912.1				21.60					21.60	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	906.2-910.7				27.20					27.20	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	910.7-911.4				30.80					30.80	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE4a	912.3-916.5				2.40					2.40	matrix	LCA	?	Williams et al., 1963	4
UE4a	917.8-918.4				41.30					41.30	matrix	LCA	?	Williams et al., 1963	4
UE15d	242.0				46.00					46.00	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE15d	258.8-259.1				16.50					16.50	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE15d	272.8-273.1				7.30					7.30	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE15d	298.7				36.30					36.30	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE15d	325.8-326.1				32.70					32.70	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE15d	337.6				29.70					29.70	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE15d	360.9				30.90					30.90	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE15d	374.9-375.2				35.10					35.10	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE15d	388.0				21.60					21.60	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE15d	393.5-393.7				34.30					34.30	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE15d	402.7				26.20					26.20	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE15d	406.9-407.2				26.30					26.30	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE15d	410.2				25.60					25.60	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE15d	429.6-429.8				33.40					33.40	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE15d	438.9-439.2				30.00					30.00	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE15d	456.3-456.5				24.30					24.30	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE15d	468.5				23.30					23.30	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE15d	487.8-488.1				26.40					26.40	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE15d	496.5				24.00					24.00	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE15d	516.7				24.80					24.80	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE15d	527.1-528.0				28.10					28.10	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4

**Appendix A
Porosity Data Set**

Well Name	Sample Depth (m)	n(E,D)	n(C,D)	n(N,D)	n(C)	n(D)	n(V)	n(N)	n(R)	Average Porosity	Porosity Type	HSU	Stratigraphic Unit	Reference	DDE-F
UE15d	535.2-535.4				24.80					24.80	matrix	TCU	Indian Trail Fm.	Williams et al., 1963	4
UE15d	541.2				3.90					3.90	matrix	LCCU	Stirling Quartzite	Williams et al., 1963	4
UE15d	563.9				3.70					3.70	matrix	LCCU	Stirling Quartzite	Williams et al., 1963	4
UE15d	588.9				4.60					4.60	matrix	LCCU	Stirling Quartzite	Williams et al., 1963	4
UE15d	589.8				7.10					7.10	matrix	LCCU	Stirling Quartzite	Williams et al., 1963	4
UE15d	593.8				7.22					7.22	matrix	LCCU	Stirling Quartzite	Williams et al., 1963	4
UE15d	657.1				1.97					1.97	matrix	LCCU	Stirling Quartzite	Williams et al., 1963	4
UE15d	713.2				1.89					1.89	matrix	LCCU	Stirling Quartzite	Williams et al., 1963	4
UE15d	747.7				2.71					2.71	matrix	LCCU	Stirling Quartzite	Williams et al., 1963	4
UE15d	772.8				4.40					4.40	matrix	LCCU	Stirling Quartzite	Williams et al., 1963	4
UE15d	776.6				6.73					6.73	matrix	LCCU	Stirling Quartzite	Williams et al., 1963	4
UE15d	807.4				10.03					10.03	matrix	LCCU	Stirling Quartzite	Williams et al., 1963	4
UE15d	836.7				4.53					4.53	matrix	LCCU	Stirling Quartzite	Williams et al., 1963	4
UE15d	865.3				4.86					4.86	matrix	LCCU	Stirling Quartzite	Williams et al., 1963	4
UE15d	895.5				6.00					6.00	matrix	LCCU	Stirling Quartzite	Williams et al., 1963	4
UE15d	896.1				6.95					6.95	matrix	LCCU	Stirling Quartzite	Williams et al., 1963	4
UE15d	929.3				2.67					2.67	matrix	LCCU	Stirling Quartzite	Williams et al., 1963	4
UE15d	956.2				0.50					0.50	matrix	LCCU	Johnnie Fm.	Williams et al., 1963	4
UE15d	1140.3				1.70					1.70	matrix	LCCU	Johnnie Fm.	Williams et al., 1963	4
UE15d	1200.6-1200.9				0.20					0.20	matrix	LCCU	Johnnie Fm.	Williams et al., 1963	4
UE15d	1265.2				0.40					0.40	matrix	LCCU	Johnnie Fm.	Williams et al., 1963	4
UE15d	1351.5-1351.8				0.50					0.50	matrix	LCCU	Johnnie Fm.	Williams et al., 1963	4
UE15d	1405.4				0.30					0.30	matrix	LCCU	Johnnie Fm.	Williams et al., 1963	4
UE15d	1600.2				4.50					4.50	matrix	LCCU	Johnnie Fm.	Williams et al., 1963	4
UE15d	1772.7-1773.0				4.50					4.50	matrix	LCCU	Noonday Dolomite	Williams et al., 1963	4
UE15d	1798.6				2.30					2.30	matrix	LCCU	Noonday Dolomite	Williams et al., 1963	4
UE15d	1802.3				0.40					0.40	matrix	LCCU	Noonday Dolomite	Williams et al., 1963	4
UE15d	1815.4				3.90					3.90	matrix	LCCU	Noonday Dolomite	Williams et al., 1963	4
UE15d	1819.0				2.50					2.50	matrix	LCCU	Noonday Dolomite	Williams et al., 1963	4
UE15d	1823.0				0.90					0.90	matrix	LCCU	Noonday Dolomite	Williams et al., 1963	4
UE15d	1825.4				0.70					0.70	matrix	LCCU	Noonday Dolomite	Williams et al., 1963	4
UE15d	1828.8				1.10					1.10	matrix	LCCU	Noonday Dolomite	Williams et al., 1963	4

Appendix B

Porosity Data Reported in the Literature as an Average per Well, or per Stratigraphic Unit

The following provides a description of the fields and codes used.

Well name	Common well or hole name. REDBOOK reporting name for wells on the NTS.

Sample Depth	Depth below land surface, at which porosity was measured

n(E,D)	Porosity from electric and density logs

n(C,D)	Porosity from core and density logs

n(N,D)	Porosity from neutron and density logs

n(C)	Porosity from core

n(D)	Porosity from density logs

n(V)	Porosity from velocity logs

n(N)	Porosity from neutron logs

n(R)	porosity from resistivity logs

Average Porosity	Average of all the values reported for that record

Porosity Type	Bulk, matrix, fracture

HSU	Hydrostratigraphic unit corresponding to the tested interval

Stratigraphic Unit	Name of stratigraphic unit corresponding to the tested interval

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Reference	Reference of source document

DDE_F	Data documentation evaluation flag

Averages or Ranges of Porosity Values

Well Name	Sample Depth (m)	n-H ₂ O con, grain, bulk density	n(C)	n(D)	n(V)	n(N)	n(R)	Ave Poros	Porosity Type	HSU	Stratigraphic Unit	Reference	DQD-F
			0.4-12.4	0.0-9.0					matrix	LCA	Lower Carbonate Aquifer	Borg et al., 1976	5
			40.00						matrix	WTA, TMA, TC	Bedded-Tuff Aquifer	Borg et al., 1976	5
			10.00						matrix	WTA, TMA, TC	Welded-Tuff Aquifer(partial welding)	Borg et al., 1976	5
			<5						matrix	WTA, TMA, TC	Welded-Tuff Aquifer(dense welding)	Borg et al., 1976	5
			0.2-10.0	0.6-5.0					matrix	LCCU	Lower Clastic Aquitard	Borg et al., 1976	5
			2.0-18.3	0.6-15.1					matrix	UCCU	Upper Clastic Aquitard	Borg et al., 1976	5
			19.8-48.3						matrix	TCB, TCU, VCU	Tuff Aquitard(Zeolitized)	Borg et al., 1976	5
				1.8-21.6					matrix	TCB, TCU, VCU	Tuff Aquitard(Argillaceous)	Borg et al., 1976	5
				10.0-30.0					matrix	TCU	Tuff Aquitard beneath Yucca Flat	Borg et al., 1976	5
				0.01-1					fracture	LCCU	Flat	Borg et al., 1976	5
				0.5-20								Borg et al., 1976	5
			14.00					14.00	matrix	TMA	Rainier Mesa Member (Timber Mountain Tuff)	Russell, 1987	5
			40.00					40.00	matrix	TC	Paintbrush Tuff	Russell, 1987	5
			19.00					19.00	matrix	TBA	Grouse Canyon Member (Belted Range Tuff)	Russell, 1987	5
			38.00					38.00	matrix	BCU	Indian Trail Formation (Tunnel Bed Unit 4)	Russell, 1987	5
			35.00					35.00	matrix	BCU	Tunnel Bed Unit 3	Russell, 1987	5
			32.00					32.00	matrix	BAQ	Tunnel Bed Unit 2	Russell, 1987	5
			25.00					25.00	matrix	BAQ	Tunnel Bed Unit 1	Russell, 1987	5
			1.7-44.4						matrix	TCTC	Rhyolitic Lava Flows of Area 20	Blankennagel and Weir, 1973	5
			1.2-26.2						matrix	TBA	Rhyolitic Lava Flows of Deadhorse Flat (welded tuff)Tiva Canyon Member of Paintbrush	Blankennagel and Weir, 1973	5
			7.2-17.2						matrix	TPTC	Tuff (welded tuff)I opopah Spring Member of	Blankennagel and Weir, 1973	5
			12.8-36.2						matrix	TPTC	Paintbrush Tuff	Blankennagel and Weir, 1973	5
			13.7-31.1						matrix	TCTC	(welded tuff)Tuffs and rhyolites of Area 20	Blankennagel and Weir, 1973	5
			12.9-33.5						matrix	TBA	(welded tuff)Lava and tuff of Deadhorse Flat (welded tuff)Grouse Canyon Member of Belted	Blankennagel and Weir, 1973	5
			4.2-24.0						matrix	TBA	Range Tuff (welded tuff)I ub Spring Member of Belted	Blankennagel and Weir, 1973	5
			8.1-38.4						matrix	TBA	Range Tuff (ash-fall and nonwelded ash-flow tuff)Local informal unit(U-12e/U-12b tunnel systems under	Blankennagel and Weir, 1973	5
			25-38						matrix	BCU	Rainier Mesa, east Pahute Mesa) (ash-fall and nonwelded ash-flow tuff)	Blankennagel and Weir, 1973	5
			28.0-44.9						matrix	TPTC	Paintbrush Tuff (ash-fall and nonwelded ash-flow tuff)I utts and	Blankennagel and Weir, 1973	5
			12.3-43.9						matrix	TCTC	rhyolites of Area 20	Blankennagel and Weir, 1973	5

Averages or Ranges of Porosity Values

Well Name	Sample Depth (m)	n-H2O con,	n(C)	n(D)	n(V)	n(N)	n(R)	Ave Poros	Porosity Type	HSU	Stratigraphic Unit	Reference	DQD-F
			29.6-50.3						matrix	TBA	(ash-fall and nonwelded ash-flow tuff)Lava and tuff of Deadhorse Flat	Blankennagel and Weir, 1973	5
			19.4-38.6						matrix	TBA	(ash-fall and nonwelded ash-flow tuff) Belted Range Tuff	Blankennagel and Weir, 1973	5
USW G-4			1.40E-02					1.40E-02	fracture	WTA	TCw=Tiva Canyon welded tuff	Klavetter and Peters, 1986	4
USW G-4			2.70E-03					2.70E-03	fracture	WTA	PTn=Paintbrush nonwelded tuff	Klavetter and Peters, 1986	4
USW G-4			4.10E-03					4.10E-03	fracture	WTA	TSw1=Topopah Spring welded tuff	Klavetter and Peters, 1986	4
USW G-4			1.80E-02					1.80E-02	fracture	WTA	TSw2=Topopah Spring welded tuff	Klavetter and Peters, 1986	4
USW G-4			4.30E-03					4.30E-03	fracture	WTA	TSw3=Topopah Spring welded tuff	Klavetter and Peters, 1986	4
USW G-4			4.60E-03					4.60E-03	fracture	WTA	CHnv=Vitric Calico Hills nonwelded tuff	Klavetter and Peters, 1986	4
USW G-4			4.60E-03					4.60E-03	fracture	WTA	CHnz=Zeolitized Calico Hills nonwelded tuff	Klavetter and Peters, 1986	4
USW G-4			1.30E-03					1.30E-03	fracture	WTA	PPw=Prow Pass welded tuff	Klavetter and Peters, 1986	4
		12+-7.6							matrix	WTA	Tiva Canyon welded unit	Montazer and Wilson, 1984	4
		46+-11							matrix	WTA	Paintbrush nonwelded unit	Montazer and Wilson, 1984	4
		14+-5.5							matrix	WTA	Topopah Spring welded unit	Montazer and Wilson, 1984	4
		37+-8							matrix	WTA	Calico Hills nonwelded unit(vitric)	Montazer and Wilson, 1984	4
		31+-7.5							matrix	WTA	Calico Hills nonwelded unit(devitrified)	Montazer and Wilson, 1984	4
		23+-6.4							matrix	WTA	Crater Flat unit	Montazer and Wilson, 1984	4
Well J-13	296-302				12 to 25				bulk	WTA	Topopah Spring Member	Thordarson, 1983	4
Well J-13	333-341				25-30				bulk	WTA	Topopah Spring Member	Thordarson, 1983	4
Well J-13	399-425				3 to 9				bulk	WTA	Topopah Spring Member	Thordarson, 1983	4
Well J-13	485-511				24-28				bulk	WTA	Tuff of Calico Hills	Thordarson, 1983	4
Well J-13	640-652				24-28				bulk	WTA	Bullfrog Member	Thordarson, 1983	4
Well J-13	652-689				23-27				bulk	WTA	Bullfrog Member	Thordarson, 1983	4
Well J-13	689-704				16-22				bulk	WTA	Bullfrog Member	Thordarson, 1983	4
Well J-13	750-809				15-28				bulk	WTA	Tram Member	Thordarson, 1983	4
Well J-13	809-869				12 to 20				bulk	WTA	Tram Member	Thordarson, 1983	4
Well J-13	869-902				16-23				bulk	WTA	Tram Member	Thordarson, 1983	4
Well J-13	902-975				17-28				bulk	WTA	Tram Member	Thordarson, 1983	4
Well J-13	975-981				24-25				bulk	VCU	Bedded tuff	Thordarson, 1983	4
Well J-13	981-1045				24-25				bulk	VCU	Tuff of Lithic Ridge	Thordarson, 1983	4
Test Well F	15.2-114.0				30			30	bulk	WLA	Wahmonie Formation	Carroll, 1963	4
Test Well F	114.0-185.9				27			27	bulk	WLA	Wahmonie Formation	Carroll, 1963	4
Test Well F	185.9-335.3				23			23	bulk	WLA	Wahmonie Formation	Carroll, 1963	4
Test Well F	335.3-451.7		13.90		18.5			16.2	bulk	WLA	Salyer Formation	Carroll, 1963	4
Test Well F	810.2-814.7		15.40	15.5		3.33		11.41	bulk	WLA	Pavits Spring Formation	Carroll, 1963	4
Test Well F	974.4		3.50			1.95		2.725	bulk	LCA	Paleozoic dolomite	Carroll, 1963	4

Averages or Ranges of Porosity Values

Well Name	Sample Depth (m)	n-H2O con,	n(C)	n(D)	n(V)	n(N)	n(R)	Ave Poros	Porosity Type	HSU	Stratigraphic Unit	Reference	DQD-F
Test Well F	451.7-518.8			30.00				30.00	bulk	WLA	Pavits Spring Formation	Carroll, 1963	4
Test Well F	518.8-551.7			22.00				22.00	bulk	WLA	Pavits Spring Formation	Carroll, 1963	4
Test Well F	551.7-629.7			16.00				16.00	bulk	WLA	Pavits Spring Formation	Carroll, 1963	4
Test Well F	629.7-699.2			20.00				20.00	bulk	WLA	Pavits Spring Formation	Carroll, 1963	4
Test Well F	699.2-757.7			19.00				19.00	bulk	WLA	Pavits Spring Formation	Carroll, 1963	4
Test Well F	699.2-807.7									WLA	Pavits Spring Formation	Carroll, 1963	4
	807.7-853.4									WLA	Pavits Spring Formation	Carroll, 1963	4
Test Well F	853.4-919.3									WLA	Pavits Spring Formation	Carroll, 1963	4
Test Well F	919.3-956.2									WLA	Pavits Spring Formation	Carroll, 1963	4
Test Well F	957.1-981.5			5.00		5.00		49	bulk	LCA	Paleozoic dolomite	Carroll, 1963	4
Test Well F	981.5-999.7			20.00				20.00	bulk	LCA	Paleozoic dolomite	Carroll, 1963	4
Test Well F	999.7-1008.9			8.00		6.00	6	35	bulk	LCA	Paleozoic dolomite	Carroll, 1963	4
Test Well F	1008.9-1021.1			23.00				23.00	bulk	LCA	Paleozoic dolomite	Carroll, 1963	4
Test Well F	1021.1-1036.3			12.00		7.00	5.5	8.16667	bulk	LCA	Paleozoic dolomite	Carroll, 1963	4
Dolomite Hill core hole						2.00	3-3.5		bulk	LCA	Devils Gate&Nevada Fm.	Schoff and Winograd, 1961	5
Dolomite Hill core hole	12.2-237.7					4-7.5			bulk	LCA	Devils Gate&Nevada Fm.	Schoff and Winograd, 1961	5
Dolomite Hill core hole			0.60						matrix	LCA	Devils Gate&Nevada Fm.	Schoff and Winograd, 1961	5
ME-4(core hole)	30.5-243.8	0.82-1.6							fracture	LCA	Pogonip Group	Schoff and Winograd, 1961	5
ME-4(core hole)	243.8-361.8	0.5-0.8							fracture	LCA	Pogonip Group	Schoff and Winograd, 1961	5
ME-4(core hole)	0-361.8					4.0-5.0			bulk	LCA	Pogonip Group	Schoff and Winograd, 1961	5
ME-4(core hole)	0-361.8		1.10						matrix	LCA	Pogonip Group	Schoff and Winograd, 1961	5
ME-4(core hole)	0-361.8	2 or 4							fracture	LCA	Pogonip Group	Schoff and Winograd, 1961	5
		0.4-0.9	%						fracture	I	Climax Stock	G.E. Walker, 1962	5
		intergranular											
		porosity < 0.4%							fracture	I	Climax Stock	G.E. Walker, 1962	5
		fracture											
		porosity=0.5-0.9							fracture	I	Climax Stock	G.E. Walker, 1962	5
			41.10					41.10	matrix	VTA	Survey Butte Member(Piapi Canyon Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			28.20					28.20	matrix	VTA	Survey Butte Member(Piapi Canyon Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			21.10					21.10	matrix	TCU	Grouse Canyon Member-Upper part(Indian Trail Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			45.20					45.20	matrix	TCU	Grouse Canyon Member-Lower part(Indian Trail Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			20.29					20.29	matrix	TCU	Tub Spring member(Indian Trail Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5

Averages or Ranges of Porosity Values

Well Name	Sample Depth (m)	n-H2O con,	n(C)	n(D)	n(V)	n(N)	n(R)	Ave Poros	Porosity Type	HSU	Stratigraphic Unit	Reference	DQD-F
			32.65					32.65	matrix	TCU	Lower Member(Indian Trail Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			2.89					2.89	matrix	TCU	Biotite tuff(Indian Trail Fm)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			39.80					39.80	matrix	VTA	Rainier Mesa-middle part(Piapi Canyon Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			32.80					32.80	matrix	VTA	Rainier Mesa-middle part(Piapi Canyon Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			33.90					33.90	matrix	VTA	Rainier Mesa-middle part(Piapi Canyon Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			23.30					23.30	matrix	VTA	Rainier Mesa-middle part(Piapi Canyon Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			37.10					37.10	matrix	VTA	Rainier Mesa-middle part(Piapi Canyon Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			18.90					18.90	matrix	VTA	Rainier Mesa-middle part(Piapi Canyon Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			21.90					21.90	matrix	VTA	Rainier Mesa-middle part(Piapi Canyon Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			7.30					7.30	matrix	VTA	Rainier Mesa-middle part(Piapi Canyon Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			9.90					9.90	matrix	VTA	Rainier Mesa-middle part(Piapi Canyon Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			10.30					10.30	matrix	VTA	Rainier Mesa-middle part(Piapi Canyon Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			42.50					42.50	matrix	VTA	Rainier Mesa-lower part(Piapi Canyon Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			38.80					38.80	matrix	VTA	Rainier Mesa-lower part(Piapi Canyon Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			8.70					8.70	matrix	VTA	Rainier Mesa-lower part(Piapi Canyon Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5

Averages or Ranges of Porosity Values

Well Name	Sample Depth (m)	n-H2O con,	n(C)	n(D)	n(V)	n(N)	n(R)	Ave Poros	Porosity Type	HSU	Stratigraphic Unit	Reference	DQD-F
			10.10					10.10	matrix	VTA	Rainier Mesa-lower part(Piapi Canyon Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			8.40					8.40	matrix	VTA	Rainier Mesa-lower part(Piapi Canyon Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			9.10					9.10	matrix	VTA	Rainier Mesa-lower part(Piapi Canyon Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			20.40					20.40	matrix	VTA	Rainier Mesa-lower part(Piapi Canyon Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			38.50					38.50	matrix	VTA	Rainier Mesa-lower part(Piapi Canyon Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			14.60					14.60	matrix	VTA	Rainier Mesa-lower part(Piapi Canyon Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			14.80					14.80	matrix	VTA	Rainier Mesa-lower part(Piapi Canyon Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			45.10					45.10	matrix	VTA	Rainier Mesa-lower part(Piapi Canyon Fm.)	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			4.88					4.88	matrix	TCU	Tiva Canyon Member	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			0.78					0.78	matrix	LCCU	Noonday Dolomite	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			2.40					2.40	matrix	LCCU	Johnnie Fm.-quartzite	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			0.50					0.50	matrix	LCCU	Johnnie Fm.-siltstone	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			1.57					1.57	matrix	LCCU	Stirling Quartzite	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			5.72					5.72	matrix	LCCU	Wood Canyon	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			1.20					1.20	matrix	LCCU	Zabriskie Quartzite	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5

Averages or Ranges of Porosity Values

Well Name	Sample Depth (m)	n-H2O con,	n(C)	n(D)	n(V)	n(N)	n(R)	Ave Poros	Porosity Type	HSU	Stratigraphic Unit	Reference	DQD-F
U10ay		31.90	1.07					1.07	matrix	LCCU	Carrara Fm.	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			1.80					1.80	matrix	LCA	Bonanza King Fm.-limestone	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			0.61					0.61	matrix	LCA	Bonanza King Fm.-dolomite	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			5.60					5.60	matrix	LCA	Windfall Fm.	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			1.17					1.17	matrix	LCA	Pogonip Group-limestone	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			0.65					0.65	matrix	LCA	Pogonip Group-dolomitic limestone	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			2.50					2.50	matrix	LCA	Pogonip Group-silty limestone	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			0.90					0.90	matrix	LCA	Pogonip Group-bioclastic limestone	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			1.40					1.40	matrix	LCA	Eureka Quartzite	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			5.97					5.97	matrix	LCA	Devils Gate-Nevada Fm.-limestone	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			6.60					6.60	matrix	LCA	Devils Gate-Nevada Fm.-dolomite	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			1.45					1.45	matrix	LCA	Devils Gate-Nevada Fm.-quartzite	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			0.90					0.90	matrix	LCA	Narrow Canyon limestone	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			3.10					3.10	matrix	LCA	Eleana Fm-limestone	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
			15.60					15.60	matrix	UCCU	Eleana Fm-argillite	Barnes, H., E.N. Hinrichs, F.A. McKeown, and P.P. Orkild, 1963	5
								31.90	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5

Averages or Ranges of Porosity Values

Well Name	Sample Depth (m)	n-H2O con,	n(C)	n(D)	n(V)	n(N)	n(R)	Ave Poros	Porosity Type	HSU	Stratigraphic Unit	Reference	DQD-F
U10ay		29.20						29.20	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U10ay		32.50						32.50	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U10ay		47.20						47.20	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U10ba		31.60						31.60	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U10ba		28.70						28.70	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U10ba		25.90						25.90	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U10ba		30.40						30.40	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U10ba		38.40						38.40	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U10bc		38.70						38.70	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U10bd		40.80						40.80	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U10bg		42.10						42.10	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U9cn		34.60						34.60	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U9cp		32.90						32.90	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U9cq		37.30						37.30	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U9cr		27.90						27.90	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U9cs		38.80						38.80	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U9cg		43.40						43.40	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U9cg		44.80						44.80	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U9cg		46.60						46.60	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U9cg		46.00						46.00	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U8e		29.40						29.40	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U8k		29.00						29.00	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U8l		32.70						32.70	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U4af		37.40						37.40	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U4af		37.70						37.70	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U4ah		34.90						34.90	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U4ah		34.40						34.40	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U4ai		35.90						35.90	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U4ai		36.80						36.80	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U4al		39.30						39.30	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U4al		38.60						38.60	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U4al		38.30						38.30	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U4al		37.00						37.00	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U4al		37.80						37.80	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ao		39.60						39.60	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ao		33.40						33.40	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ao		40.50						40.50	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ao		34.20						34.20	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ar		31.10						31.10	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5

Averages or Ranges of Porosity Values

Well Name	Sample Depth (m)	n-H2O con,	n(C)	n(D)	n(V)	n(N)	n(R)	Ave Poros	Porosity Type	HSU	Stratigraphic Unit	Reference	DQD-F
U2ar		32.30						32.30	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ar		33.70						33.70	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ar		37.40						37.40	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ar		38.70						38.70	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ar		41.30						41.30	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2bx		40.00						40.00	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2bx		37.00						37.00	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2bx		32.00						32.00	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2bx		35.00						35.00	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2bw		34.70						34.70	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2bw		36.50						36.50	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2bw		32.00						32.00	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2bw		26.30						26.30	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2bw		33.40						33.40	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2bw		34.60						34.60	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2do		41.00						41.00	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2do		36.00						36.00	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2do		28.00						28.00	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2do		34.00						34.00	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2do		30.00						30.00	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2dq		40.00						40.00	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2dq		37.40						37.40	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2dq		30.30						30.30	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2dz		32.70						32.70	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2dz		27.50						27.50	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2dz		41.40						41.40	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ef		31.60						31.60	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ef		29.90						29.90	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ef		30.30						30.30	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ef		35.10						35.10	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ek		33.00						33.00	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ek		36.00						36.00	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2eh		29.50						29.50	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2eh		29.50						29.50	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2eh		30.10						30.10	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ec		37.50						37.50	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ec		36.70						36.70	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ec		35.10						35.10	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ec		34.00						34.00	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5

Averages or Ranges of Porosity Values

Well Name	Sample Depth (m)	n-H2O con,	n(C)	n(D)	n(V)	n(N)	n(R)	Ave Poros	Porosity Type	HSU	Stratigraphic Unit	Reference	DQD-F
U2ec		32.20						32.20	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ec		32.20						32.20	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ec		36.60						36.60	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ei		33.40						33.40	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ei		34.80						34.80	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2el		33.10						33.10	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2el		33.00						33.00	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2el		37.80						37.80	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2en		35.30						35.30	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2eo		26.60						26.60	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2eo		30.90						30.90	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ep		31.80						31.80	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ep		39.20						39.20	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ep		32.70						32.70	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2ep		39.90						39.90	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2eq		34.30						34.30	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2eq		34.30						34.30	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2eq		34.70						34.70	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2fa		29.90						29.90	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2fa		30.60						30.60	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2fa		34.20						34.20	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2fa		36.30						36.30	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2fa		37.00						37.00	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2fa		36.50						36.50	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2fc		29.90						29.90	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2fc		28.50						28.50	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2fc		33.30						33.30	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2fc		35.70						35.70	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2fc		37.70						37.70	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2fd		34.20						34.20	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2fd		28.10						28.10	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2fd		26.40						26.40	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2fd		29.90						29.90	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2fd		34.70						34.70	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2fd		35.10						35.10	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2fd		33.70						33.70	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U2gf		32.60						32.60	bulk	AA	QTAL=Alluvium	Norman R. Burkhard, 1989	5
U10be		26.00						26.00	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U10bf		25.10						25.10	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5

Averages or Ranges of Porosity Values

Well Name	Sample Depth (m)	n-H2O con,	n(C)	n(D)	n(V)	n(N)	n(R)	Ave Poros	Porosity Type	HSU	Stratigraphic Unit	Reference	DQD-F
U10bn		29.10						29.10	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U10ca		31.10						31.10	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U10cb		30.00						30.00	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U10cc		27.40						27.40	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U8c		31.50						31.50	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U8j		25.20						25.20	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U8m		30.70						30.70	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U4j		34.00						34.00	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U4ar		36.30						36.30	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U4ar		33.20						33.20	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U4ar		35.70						35.70	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U4ar		34.80						34.80	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U4ar		38.20						38.20	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U4ac		37.20						37.20	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U4ac		37.80						37.80	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U4aj		34.00						34.00	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U4am		37.30						37.30	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U4am		33.50						33.50	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U4am		37.00						37.00	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U4ak		36.30						36.30	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U4ak		36.30						36.30	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U4at		38.20						38.20	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U4as		32.50						32.50	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U4au		37.10						37.10	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U2cu		27.80						27.80	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U2co		28.20						28.20	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U2cp		30.30						30.30	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U2cr		31.10						31.10	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U2cs		32.80						32.80	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U2er		32.80						32.80	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U2eu		36.70						36.70	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U2eu		29.60						29.60	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U2eu		28.90						28.90	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U2eu		25.60						25.60	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U2eu		32.40						32.40	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U2eu		*							bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U2es		32.50						32.50	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U2et		35.20						35.20	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U2ev		32.40						32.40	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5

Averages or Ranges of Porosity Values

Well Name	Sample Depth (m)	n-H2O con,	n(C)	n(D)	n(V)	n(N)	n(R)	Ave Poros	Porosity Type	HSU	Stratigraphic Unit	Reference	DQD-F
U2ev		36.30						36.30	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U2ex		35.30						35.30	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U2ey		32.60						32.60	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U2ew		37.10						37.10	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U2fb		31.00						31.00	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U2fe		28.10						28.10	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U2ff		29.50						29.50	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U2gas		38.00						38.00	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U2gb		35.00						35.00	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U2ge		30.60						30.60	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U2gg		35.90						35.90	bulk	AA	QTMA=Mixed alluvium	Norman R. Burkhard, 1989	5
U10be		35.00						35.00	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U10bf		44.50						44.50	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U10bh		42.40						42.40	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U8c		35.70						35.70	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U8j		36.90						36.90	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U4j		36.90						36.90	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U4aj		36.90						36.90	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U4am		48.80						48.80	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U4ak		43.30						43.30	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U4at		35.90						35.90	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U4as		36.20						36.20	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U2cu		35.10						35.10	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U2co		37.50						37.50	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U2cp		44.20						44.20	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U2cs		38.90						38.90	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U2er		41.40						41.40	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U2eu		*							bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U2es		37.30						37.30	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U2et		35.30						35.30	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U2ex		43.40						43.40	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U2ey		45.60						45.60	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U2ew		35.80						35.80	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U2fb		33.30						33.30	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U2ff		35.10						35.10	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U2gas		48.30						48.30	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U2ge		38.50						38.50	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U2gg		43.50						43.50	bulk	AA	QTTA=Basal tuffaceous alluvium	Norman R. Burkhard, 1989	5
U8c		45.40						45.40	bulk	TCU	TB=Bedded tuff	Norman R. Burkhard, 1989	5

Averages or Ranges of Porosity Values

Well Name	Sample Depth (m)	n-H2O con,	n(C)	n(D)	n(V)	n(N)	n(R)	Ave Poros	Porosity Type	HSU	Stratigraphic Unit	Reference	DQD-F
U8e		43.60						43.60	bulk	TCU	TB=Bedded tuff	Norman R. Burkhard, 1989	5
U8j		38.70						38.70	bulk	TCU	TB=Bedded tuff	Norman R. Burkhard, 1989	5
U2gg		41.00						41.00	bulk	TCU	TB=Bedded tuff	Norman R. Burkhard, 1989	5
U10bc		56.50						56.50	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U10bd		50.00						50.00	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U10be		49.30						49.30	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U10bf		56.20						56.20	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U10bg		62.60						62.60	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U9cn		57.80						57.80	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U9cp		51.90						51.90	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U9cq		52.50						52.50	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U9cr		58.90						58.90	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U9cs		52.00						52.00	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U9cw		52.10						52.10	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U8e		39.30						39.30	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U8j		57.10						57.10	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U8m		52.00						52.00	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U8n		55.10						55.10	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U4ah		49.70						49.70	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U4ai		47.70						47.70	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U4ak		44.10						44.10	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U4at		67.50						67.50	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U4as		63.60						63.60	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U2cu		61.50						61.50	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U2co		49.30						49.30	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U2cr		67.90						67.90	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U2cs		56.10						56.10	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U2dq		51.80						51.80	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U2ei		47.60						47.60	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U2er		56.00						56.00	bulk	TCU	TBG=Grouse Canyon Member	Norman R. Burkhard, 1989	5
U9cp		45.40						45.40	bulk	TCU	TBR	Norman R. Burkhard, 1989	5
U9cp		41.30						41.30	bulk	TCU	TBR	Norman R. Burkhard, 1989	5
U8c		41.30						41.30	bulk	TCU	TF=Fraction Tuff	Norman R. Burkhard, 1989	5
U8k		39.50						39.50	bulk	TCU	TF=Fraction Tuff	Norman R. Burkhard, 1989	5
U8m		43.30						43.30	bulk	TCU	TF=Fraction Tuff	Norman R. Burkhard, 1989	5
U4j		46.10						46.10	bulk	WTA	TMA=AmmoniaTanks Member	Norman R. Burkhard, 1989	5
U4aj		46.10						46.10	bulk	WTA	TMA=AmmoniaTanks Member	Norman R. Burkhard, 1989	5
U4ak		44.00						44.00	bulk	WTA	TMA=AmmoniaTanks Member	Norman R. Burkhard, 1989	5
U4at		37.00						37.00	bulk	WTA	TMA=AmmoniaTanks Member	Norman R. Burkhard, 1989	5

Averages or Ranges of Porosity Values

Well Name	Sample Depth (m)	n-H2O con,	n(C)	n(D)	n(V)	n(N)	n(R)	Ave Poros	Porosity Type	HSU	Stratigraphic Unit	Reference	DQD-F
U4as		42.70						42.70	bulk	WTA	TMA=AmmoniaTanks Member	Norman R. Burkhard, 1989	5
U4au		40.30						40.30	bulk	WTA	TMA=AmmoniaTanks Member	Norman R. Burkhard, 1989	5
U4au		43.10						43.10	bulk	WTA	TMA=AmmoniaTanks Member	Norman R. Burkhard, 1989	5
U2dq		44.20						44.20	bulk	WTA	TMA=AmmoniaTanks Member	Norman R. Burkhard, 1989	5
U2en		47.60						47.60	bulk	WTA	TMA=AmmoniaTanks Member	Norman R. Burkhard, 1989	5
U2eo		37.60						37.60	bulk	WTA	TMA=AmmoniaTanks Member	Norman R. Burkhard, 1989	5
U2ex		43.40						43.40	bulk	WTA	TMA=AmmoniaTanks Member	Norman R. Burkhard, 1989	5
U2gas		51.70						51.70	bulk	WTA	TMA=AmmoniaTanks Member	Norman R. Burkhard, 1989	5
U2gb		51.20						51.20	bulk	WTA	TMA=AmmoniaTanks Member	Norman R. Burkhard, 1989	5
U4ar		39.90						39.90	bulk	WTA	TMB=BeddedAmmoniaTanks	Norman R. Burkhard, 1989	5
U4at		43.20						43.20	bulk	WTA	TMB=BeddedAmmoniaTanks	Norman R. Burkhard, 1989	5
U4as		49.00						49.00	bulk	WTA	TMB=BeddedAmmoniaTanks	Norman R. Burkhard, 1989	5
U2co		43.10						43.10	bulk	WTA	TMB=BeddedAmmoniaTanks	Norman R. Burkhard, 1989	5
U2cp		44.00						44.00	bulk	WTA	TMB=BeddedAmmoniaTanks	Norman R. Burkhard, 1989	5
U2cq		46.00						46.00	bulk	WTA	TMB=BeddedAmmoniaTanks	Norman R. Burkhard, 1989	5
U2gf		51.40						51.40	bulk	WTA	TMB=BeddedAmmoniaTanks	Norman R. Burkhard, 1989	5
U9cp		38.70						38.70	bulk	VTa	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5
U0cq		42.90						42.90	bulk	VTa	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5
U9cr		48.00						48.00	bulk	VTa	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5
U9cs		43.60						43.60	bulk	VTa	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5
U9cw		41.70						41.70	bulk	VTa	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5
U8m		37.70						37.70	bulk	VTa	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5
U8n		31.70						31.70	bulk	VTa	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5
U4j		37.60						37.60	bulk	VTa	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5
U4aj		37.60						37.60	bulk	VTa	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5
U4at		38.90						38.90	bulk	VTa	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5
U4as		42.80						42.80	bulk	VTa	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5
U2co		40.40						40.40	bulk	VTa	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5
U2cp		43.00						43.00	bulk	VTa	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5
U2cs		40.30						40.30	bulk	VTa	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5
U2cq		39.30						39.30	bulk	VTa	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5
U2dq		30.80						30.80	bulk	VTa	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5
U2ek		43.00						43.00	bulk	VTa	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5
U2ei		36.30						36.30	bulk	VTa	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5
U2el		49.10						49.10	bulk	VTa	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5
U2eo		40.40						40.40	bulk	VTa	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5
U2es		39.30						39.30	bulk	VTa	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5
U2ex		32.80						32.80	bulk	VTa	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5
U2ew		38.20						38.20	bulk	VTa	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5

Averages or Ranges of Porosity Values

Well Name	Sample Depth (m)	n-H2O con,	n(C)	n(D)	n(V)	n(N)	n(R)	Ave Poros	Porosity Type	HSU	Stratigraphic Unit	Reference	DQD-F
U2fb		43.70						43.70	bulk	VTA	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5
U2gb		37.40						37.40	bulk	VTA	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5
U2gf		53.00						53.00	bulk	VTA	TMR=RainierMesaMember	Norman R. Burkhard, 1989	5
U8e		36.70						36.70	bulk	TCU	TMR+TP	Norman R. Burkhard, 1989	5
U2ek		45.00						45.00	bulk	TCU	TMR+TP	Norman R. Burkhard, 1989	5
U10ba		38.90						38.90	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U10bc		54.50						54.50	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U10bd		48.30						48.30	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U10be		42.30						42.30	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U10bf		44.90						44.90	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U10bg		51.40						51.40	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U9cn		49.50						49.50	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U9cp		43.70						43.70	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U9cq		46.50						46.50	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U9cq		47.70						47.70	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U9cr		48.20						48.20	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U9cs		44.00						44.00	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U9cw		45.70						45.70	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U8m		41.40						41.40	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U4j		40.60						40.60	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U4ah		42.60						42.60	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U4aj		40.60						40.60	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U4am		48.60						48.60	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U4at		45.00						45.00	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U4as		45.70						45.70	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U2cu		47.80						47.80	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U2co		37.00						37.00	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U2cp		41.00						41.00	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U2cr		50.90						50.90	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U2cs		46.50						46.50	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U2cq		39.60						39.60	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U2dq		38.00						38.00	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U2ei		39.10						39.10	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U2eo		36.10						36.10	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U2es		42.40						42.40	bulk	TCU	TP=PaintbrushTuff	Norman R. Burkhard, 1989	5
U4af		47.50						47.50	bulk	TCU	TP+TBG	Norman R. Burkhard, 1989	5
U8c		48.00						48.00	bulk	TCU	TRV=Red Rock Valley Tuff	Norman R. Burkhard, 1989	5
U8j		36.30						36.30	bulk	TCU	TRV=Red Rock Valley Tuff	Norman R. Burkhard, 1989	5
U8k		48.70						48.70	bulk	TCU	TRV=Red Rock Valley Tuff	Norman R. Burkhard, 1989	5

Averages or Ranges of Porosity Values

Well Name	Sample Depth (m)	n-H2O con,	n(C)	n(D)	n(V)	n(N)	n(R)	Ave Poros	Porosity Type	HSU	Stratigraphic Unit	Reference	DQD-F
U8m		50.30						50.30	bulk	TCU	TRV=Red Rock Valley Tuff	Norman R. Burkhard, 1989	5
U10bc		44.70						44.70	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U10bc		39.20						39.20	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U10bd		42.90						42.90	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U10be		41.60						41.60	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U10bf		37.60						37.60	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U10bg		45.40						45.40	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U10ca		43.80						43.80	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U10ca		43.70						43.70	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U10cb		43.40						43.40	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U10cc		43.30						43.30	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U9cn		37.80						37.80	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U9cq		44.50						44.50	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U9cr		46.40						46.40	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U9cs		42.20						42.20	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U9cw		52.40						52.40	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U8c		44.10						44.10	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U8c		47.60						47.60	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U8e		45.50						45.50	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U8e		44.90						44.90	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U8j		43.10						43.10	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U8j		45.20						45.20	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U8k		41.70						41.70	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U8k		42.80						42.80	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U8l		44.70						44.70	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U8l		46.10						46.10	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U8m		42.60						42.60	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U8m		44.10						44.10	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U8n		44.00						44.00	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U8n		40.90						40.90	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U4af		43.80						43.80	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U4at		47.50						47.50	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U4as		55.10						55.10	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U2cu		46.40						46.40	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U2cu		42.60						42.60	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U2co		36.00						36.00	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U2co		38.70						38.70	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U2cr		49.90						49.90	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U2cr		45.50						45.50	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5

Averages or Ranges of Porosity Values

Well Name	Sample Depth (m)	n-H2O con,	n(C)	n(D)	n(V)	n(N)	n(R)	Ave Poros	Porosity Type	HSU	Stratigraphic Unit	Reference	DQD-F
U2cs		46.20						46.20	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U2cs		41.60						41.60	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U2dq		42.10						42.10	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U2er		50.60						50.60	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U2et		32.80						32.80	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U2et		38.90						38.90	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U2ey		48.90						48.90	bulk	TCU	TTB=Tunnel Beds	Norman R. Burkhard, 1989	5
U10be		40.00						40.00	bulk	TCU	TTS=TubSpringMember	Norman R. Burkhard, 1989	5
U10ca		44.70						44.70	bulk	TCU	TTS=TubSpringMember	Norman R. Burkhard, 1989	5
U10cb		46.00						46.00	bulk	TCU	TTS=TubSpringMember	Norman R. Burkhard, 1989	5
U10cc		46.20						46.20	bulk	TCU	TTS=TubSpringMember	Norman R. Burkhard, 1989	5
U8c		56.70						56.70	bulk	TCU	TTS=TubSpringMember	Norman R. Burkhard, 1989	5
U8j		47.00						47.00	bulk	TCU	TTS=TubSpringMember	Norman R. Burkhard, 1989	5
U8k		51.60						51.60	bulk	TCU	TTS=TubSpringMember	Norman R. Burkhard, 1989	5
U8l		56.10						56.10	bulk	TCU	TTS=TubSpringMember	Norman R. Burkhard, 1989	5
U8m		51.40						51.40	bulk	TCU	TTS=TubSpringMember	Norman R. Burkhard, 1989	5
U8n		47.00						47.00	bulk	TCU	TTS=TubSpringMember	Norman R. Burkhard, 1989	5
U2cu		39.00						39.00	bulk	TCU	TTS=TubSpringMember	Norman R. Burkhard, 1989	5
U2co		44.40						44.40	bulk	TCU	TTS=TubSpringMember	Norman R. Burkhard, 1989	5
U2cr		41.90						41.90	bulk	TCU	TTS=TubSpringMember	Norman R. Burkhard, 1989	5
U10bd		44.50						44.50	bulk	TCU	TU=Undifferentiatedtuff	Norman R. Burkhard, 1989	5
U8c		40.40						40.40	bulk	TCU	TU=Undifferentiatedtuff	Norman R. Burkhard, 1989	5
U8k		40.10						40.10	bulk	TCU	TU=Undifferentiatedtuff	Norman R. Burkhard, 1989	5
U4ah		42.40						42.40	bulk	TCU	TU=Undifferentiatedtuff	Norman R. Burkhard, 1989	5

Appendix C

Detailed Statistical Summaries of the Porosity Data

This appendix contains 20 tables providing summary statistics on porosity data by HSU type and by porosity type. Each table contains two columns specifying the name and the value of the specific statistical variable. The following provides a description of the codes used in the table labels:

Aquifer labels

AA	Alluvial Aquifer
BAQ	Basal Aquifer
BCU	Basal Confining Unit
TBA	Belted Range Aquifer
LCA	Lower Carbonate Aquifer
LCCU	Lower Clastic Confining Unit
TCU	Tuff Confining Unit
TPTA	Topopah Springs Tuff Aquifer
TMA	Timber Mountain Aquifer
UCCU	Upper Clastic Confining Unit
VCU	Volcanic Confining Unit
VTa	Vitric Tuff Aquifer
WTA	Welded Tuff Aquifer
WLA	Wahmonie Lava Aquifer

Porosity Labels

Bulk	Bulk porosity
Matrix	Matrix porosity
Fracture	Fracture porosity

Summary Statistics

AA	BULK
Mean	36.3
Standard Error	0.8
Median	38.5
Mode	38.5
Standard Deviation	8.9
Variance	79.8
Kurtosis	0.4
Skewness	-0.9
Range	43
Minimum	10
Maximum	53
Sum	4577.9
Count	126

AA	MATRIX
Mean	25.2
Standard Error	1.3
Median	25.3
Mode	28.5
Standard Deviation	5.7
Variance	32.3
Kurtosis	1.3
Skewness	0
Range	25.2
Minimum	13.4
Maximum	38.6
Sum	453
Count	18

BAQ	BULK
Mean	14.3
Standard Error	1.5
Median	14.5
Mode	12
Standard Deviation	4.6
Variance	20.9
Kurtosis	0.2
Skewness	0.6
Range	14.5
Minimum	8.5
Maximum	23
Sum	129
Count	9

BAQ	MATRIX
Mean	18.4
Standard Error	1.1
Median	18.1
Mode	11.5
Standard Deviation	5.3
Variance	28.6
Kurtosis	-1.1
Skewness	0.2
Range	18
Minimum	9.1
Maximum	27.1
Sum	460.6
Count	25

BCU	MATRIX
Mean	38.3
Standard Error	0.9
Median	37.8
Mode	28.5
Standard Deviation	3.7
Variance	13.4
Kurtosis	-0.8
Skewness	0.4
Range	12
Minimum	33.2
Maximum	45.2
Sum	612.6
Count	16

TBA	BULK
Mean	28.4
Standard Error	3.1
Median	33
Mode	33
Standard Deviation	8.2
Variance	66.6
Kurtosis	-2.2
Skewness	-0.1
Range	20
Minimum	19
Maximum	39
Sum	199
Count	7

Summary Statistics

LCA BULK

Mean	11.7
Standard Error	0.3
Median	12
Mode	12
Standard Deviation	0.6
Variance	0.3
Kurtosis	NA
Skewness	-1.7
Range	1
Minimum	11
Maximum	12
Sum	35
Count	3

LCA MATRIX

Mean	3.8
Standard Error	0.6
Median	3.1
Mode	1.5
Standard Deviation	2.7
Variance	7.5
Kurtosis	0.6
Skewness	1.1
Range	9.6
Minimum	0.3
Maximum	9.9
Sum	67.6
Count	18

LCA FRACTURE

Mean	9
Standard Error	0.6
Median	9
Mode	NA
Standard Deviation	1
Variance	1
Kurtosis	NA
Skewness	0
Range	2
Minimum	8
Maximum	10
Sum	27
Count	3

LCCU MATRIX

Mean	3.3
Standard Error	0.5
Median	2.7
Mode	0.4
Standard Deviation	2.6
Variance	6.5
Kurtosis	-0.1
Skewness	0.7
Range	9.8
Minimum	0.2
Maximum	10
Sum	103.7
Count	31

TCU MATRIX

Mean	28.1
Standard Error	0.9
Median	27.2
Mode	24.8
Standard Deviation	8
Variance	64
Kurtosis	0.4
Skewness	0.3
Range	40.2
Minimum	7.3
Maximum	47.5
Sum	2109.7
Count	75

TPTA MATRIX

Mean	23.7
Standard Error	NA
Median	NA
Mode	NA
Standard Deviation	NA
Variance	NA
Kurtosis	NA
Skewness	NA
Range	NA
Minimum	NA
Maximum	NA
Sum	NA
Count	1

Summary Statistics

TMA	BULK
Mean	16.2
Standard Error	0.6
Median	12
Mode	5.1
Standard Deviation	11.5
Variance	132.3
Kurtosis	0.6
Skewness	1.2
Range	54.9
Minimum	3.4
Maximum	58.3
Sum	5365.5
Count	332

TMA	MATRIX
Mean	23.2
Standard Error	2.3
Median	21
Mode	10
Standard Deviation	13.1
Variance	172.8
Kurtosis	-0.8
Skewness	0.6
Range	47
Minimum	7
Maximum	54
Sum	742.8
Count	32

UCCU	MATRIX
Mean	8.8
Standard Error	0.8
Median	8.6
Mode	2.6
Standard Deviation	4.5
Variance	20.6
Kurtosis	1.4
Skewness	0.8
Range	21.3
Minimum	1.3
Maximum	22.6
Sum	298.6
Count	34

VCU	MATRIX
Mean	16
Standard Error	0.7
Median	16
Mode	17.9
Standard Deviation	3.6
Variance	13
Kurtosis	0.1
Skewness	0.1
Range	14.3
Minimum	9.2
Maximum	23.5
Sum	447.6
Count	28

VTA	MATRIX
Mean	34
Standard Error	2.2
Median	39.1
Mode	41
Standard Deviation	9.2
Variance	84.3
Kurtosis	-1.6
Skewness	-0.5
Range	24.1
Minimum	19.9
Maximum	44
Sum	578.8
Count	17

WTA	MATRIX
Mean	20
Standard Error	0.5
Median	16.7
Mode	9
Standard Deviation	11.8
Variance	138.1
Kurtosis	0.8
Skewness	1
Range	63.6
Minimum	1.4
Maximum	65
Sum	12750.1
Count	639

Summary Statistics

WLA	BULK	WLA	MATRIX
Mean	16	Mean	27.4
Standard Error	0.7	Standard Error	1
Median	15.7	Median	27
Mode	NA	Mode	NA
Standard Deviation	1.7	Standard Deviation	3.7
Variance	2.8	Variance	13.8
Kurtosis	-0.2	Kurtosis	-1.2
Skewness	0.7	Skewness	0.2
Range	4.6	Range	11.2
Minimum	14	Minimum	22.3
Maximum	18.7	Maximum	33.5
Sum	95.9	Sum	356
Count	6	Count	13