SECTION 6

DESIGN CONCEPT SURFACE ASSUMPTIONS (DCS)

99 ϕ 224 ϕ 399 - Part 2

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCS 001 Subject: MGDS Operational Center

I. STATEMENT OF ASSUMPTION

A future Mined Geologic Disposal System (MGDS) operational center will be required to maintain communications with the transportation network, maintain inventories, and support security and safeguards requirements. This center will be located at the repository.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

General functions and location are assumed to assign budgeting criteria.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Probable functional requirements to be established by Trans-RD:

This center could maintain communications with all casks in transit and will maintain constant records of the spent nuclear fuel (SNF) being transported to the MGDS. All spent nuclear fuel (SNF) in lag storage or being handled will be tracked throughout the MGDS. Records that identify the emplacement location of each and every fuel assembly will be maintained in this facility. Incoming and outgoing casks will be tracked and their status monitored. This facility could act as the Geologic Repository Operations Area (GROA) center for emergency control.

This facility could maintain the necessary records to maintain conformance to all safeguards and security requirements.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCS 008 **Subject:** Decontamination Equipment and Space

I. STATEMENT OF ASSUMPTION

Necessary equipment and space required for decontamination will be provided in each building where contamination will be present.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

To prevent the spread of contamination that would occur by having to transport all contaminated items to a central decontamination facility, provisions will be provided to perform these activities as near to the source of contamination as possible and to "promote waste minimization." The Decontamination Facility cited in the Site Characterization Plan (SCP)/Conceptual Design Report (CDR) will not be used. This assumption substitutes the necessary equipment and space needed for decontamination.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Surface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCS 011 **Subject:** Underground Waste Generation

I. STATEMENT OF ASSUMPTION

Significant quantities of secondary mixed or low-level radioactive wastes will not be generated by underground emplacement operations.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Key Assumption 024 indicates facilities will be located at the Geologic Repository Operations Area (GROA) to process and package onsite generated radioactive low-level waste (LLW). Key Assumption 024 also assumes nonradioactive waste will not be sent to the LLW processing facility.

Need for assumption (statement of intended use):

An underground radiologically controlled area (RCA) waste assumption is needed to design the waste treatment facility and processes.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The emplacement area of the underground is assumed to be within the radiologically controlled area (RCA) but is not expected to be manned. Significant secondary mixed or low-level waste materials should not be generated. Underground hazardous wastes will not be sent to the facilities processing LLW in order to maintain separation of the hazardous and low-level waste, as defined in Key Assumption 024.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCS 012 **Subject: No HLW in Waste Treatment Building**

I. STATEMENT OF ASSUMPTION

The Waste Treatment Building (WTB) will not process secondary transuranic or high-level waste (HLW). If such waste materials are generated, they will be packaged at the point of generation and disposed in the underground emplacement area via the Waste Handling Building (WHB).

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Current controlled assumptions do not address secondary transuranic or HLW disposition. This assumption is needed to design the WTB, any other surface facilities that could generate these materials, and the underground facilities. Impact on the underground design is expected to be negligible.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The facilities that could generate HLW, such as the Cask Maintenance Facility (CMF) or Waste Handling Building (WHB), are designed for HLW operations (e.g., underwater or in hot cells) and could better accommodate handling secondary HLW packaging. The WTB will be designed primarily for contact operations involving low-level radioactive waste (LLRW) materials.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Surface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCS 013

Subject: Waste Generated by Performance Confirmation Activities

I. STATEMENT OF ASSUMPTION

Waste quantities generated by the performance confirmation operations will be negligible.

As a result, wastes generated by the performance confirmation operations will not impact the design of the Waste Treatment Building (WTB).

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

It is necessary to assume the impact of the unspecified mission of the performance confirmation operations on the design of the Waste Treatment Building (WTB) and the waste treatment processes.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Assumption is based on the 1996 Management and Operating Contractor (M&O) Performance Confirmation Concept Study (B00000000-01717-5705-00035). Destructive testing on waste packages will be conducted only if these are recovered on a contingency basis.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Surface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCS 019 **Subject: Support Facilities Design**

I. STATEMENT OF ASSUMPTION

Support Facilities comprise those described in the Site Characterization Project Conceptual Design Report (SCP-CDR) and will not be addressed within Viability Assessment (VA) design efforts.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, or ( ) Other (specify):

Need for assumption (statement of intended use):

Focus of VA design effort.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Support facilities design is assumed to follow standard practice.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Surface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCS 020 **Subject: WHB Wet/Dry Handling**

I. STATEMENT OF ASSUMPTION

The Waste Handling Building (WHB) will use a wet waste handling concept using fuel pools for opening casks and dual-purpose canisters (DPCs) and removing and staging the SNF assemblies. Other operations, including the loading of SNF assemblies into disposal containers and all handling of disposal canisters for HLW, DOE SNF and commercial SNF, will be performed in dry hot cells.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:
(X) Surface, ( ) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Clarification that the WHB will use fuel pools for selected applications and dry hot cells for other applications. This concept, as summarized above in the Statement of Assumption, is described as the "Wet Waste Handling System" and presented as the recommended concept in the *Waste Handling Systems Configuration Analysis* (CRWMS M&O 1997b). The assumption is included to establish a program position for the concept as recommended in this approved analysis.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgement:

The current Waste Form Scenario includes predominantly uncanistered waste and waste packaged in non-reusable DPCs, distinctly different from the Multi-Purpose Canister (disposable canister) that was a basis for the Advanced Conceptual Design. The *Waste Handling Systems Configuration Analysis* included a material handling simulation and decisions analysis to compare wet and dry design alternatives for the uncanistered waste form scenarios, and recommended a wet waste handling system concept based on optimum performance effectiveness.

The wet waste handling system concept is selected based on the throughput required to handle a significant increase in spent fuel assemblies at the Repository, and it utilizes proven methods and equipment for handling spent fuel assemblies in a pool environment for similar applications. In addition, there are advantages of reduced occupational exposure during maintenance and recovery operations, and reduced life cycle cost.

Assumption Identifier: DCS 020 (continued) **Subject:** WHB Wet/Dry Handling

IV. RESPONSIBILITY/SUBSTANTIATION/WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Surface Design

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCS 021

Subject: Special Tooling

I. STATEMENT OF ASSUMPTION

The Waste Handling Building will include the flexibility to receive, handle, and unload a variety of shipping casks and canisters. Special tooling (yokes, grapples, fixtures, etc.) will be required to handle these waste form configurations as defined in Key Assumptions 001, 002, and 003. The maximum number of types that will be received at the repository are as follows:

* Shipping Casks (15 types)
* Spent Fuel Assemblies (12 types)
* Disposal Containers (6 types)
* Disposable Canisters (3 types)

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, or ( ) Other (specify):

Need for assumption (statement of intended use):

Scoping of the waste handling design and sizing of storage spaces.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The number of types were estimated by the Surface Design based on the variety of waste form configurations that are expected.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Surface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

SECTION 7

DESIGN CONCEPT SUBSURFACE ASSUMPTIONS (DCSS)

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 001 **Subject: Drift Orientation**

I. STATEMENT OF ASSUMPTION

Preferred drift orientation:

- Orientation of emplacement drifts will be at least 30 degrees from dominant joint orientations. Using the information on joint orientations in Assumption TDSS 017, the emplacement drift orientation will generally fall between N70W and S75W.

- Orientation of maintainable access drifts, mains, ramps, etc. will be as needed to complement emplacement drift orientation, generally forming intersections of 70-90 degrees where practicable.

Contingency drift orientation:

Contingency layouts not meeting the preferred orientations are required in case substantiation of TDSS-017 indicates the joint orientations assumed are incorrect.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Geometric guidance for repository layouts.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Engineering judgment in order to maximize stability of emplacement drifts and accept less than maximum stability in other excavations. This is based on a philosophy or desire to eliminate having to enter emplacement drifts, where heat and radiation pose formidable problems, to perform maintenance on a regular basis. Lesser stability is acceptable in other excavations because maintenance on a regular basis does not have to overcome formidable problems. The 30 degrees needs no substantiation. The actual emplacement drift orientations will depend on the dominant joint orientations as confirmed during site characterization. There is a need (10CFR60.21(c)(ii)(D)) to study alternatives and to be prepared with contingency layouts if the joint orientation changes from that assumed.

Assumption Identifier: DCSS 001 (continued) **Subject:** Drift Orientation

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 005 **Subject: Drift Excavation Methods**

I. STATEMENT OF ASSUMPTION

Drift excavation methods:

- Primary: tunnel boring machine (TBM)
- Secondary: other mechanical methods, and where mechanical methods are impractical, drill-and-blast may be used to a limited degree primarily in non-emplacement areas of the repository.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects the layout of drifts in plan.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Applicable regulations and recommendations by oversight organizations support the use of mechanical excavation.

- 10 CFR 60.133(e)(2): Openings shall be designed to reduce deleterious rock movement.
- 10 CFR 30.133(f): Use excavation methods that limit potential for creating preferential pathways for groundwater.
- NUREG 1347, *Staff Site Characterization Analysis of the Department of Energy's Site Characterization Plan, Yucca Mountain* (NRC 1989), Comment 132: Compare the alternatives of drilling and blasting and mechanical excavation methods.
- NWTRBs First Report to Congress: Maximize use of the most modern mechanical excavation techniques in studies of tunnel excavation methods.

The excavation methods were documented in *Mined Geologic Disposal System Advanced Conceptual Design Report*, March 1996, B00000000-01717-5705-00027, Rev. 00, and were retained in the design products during Viability Assessment.

Assumption Identifier: DCSS 005 (continued) **Subject:** Drift Excavation Methods

The ramps and one of the access/service mains for the repository were excavated by TBM as part of the Exploratory Studies Facility (ESF). Approximately 6000 m ESF excavation by TBM demonstrates the viability of using a TBM for repository excavation.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 006 **Subject: Maximum Excavation Extraction Ratio**

I. STATEMENT OF ASSUMPTION

Maximum excavation extraction ratio for emplacement drifts: 30 percent.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects layout of excavations.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Excavation extraction ratio is defined as the area (in plan view) excavated divided by the total area considered. The 30 percent is a conservative value to promote long-term opening stability. It has its basis in two-dimensional elastic stress analysis. For two circular openings in a hydrostatic stress field, there is essentially no stress increase felt at one tunnel due to the presence of the other tunnel for center-to-center tunnel spacings of three diameters or greater. (Three diameter center-to-center spacing equals 33 percent excavation extraction ratio.) Rev. 01 of the Controlled Design Assumptions (CDA) is to limit this to emplacement areas and exclude it from the areas where no emplacement occurs.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 009 **Subject: Maximum Grade of Drifts**

I. STATEMENT OF ASSUMPTION

Maximum grade in mains: minimize, but ≤2 percent in mains used for emplacement drift access.

Maximum grade in emplacement drifts: minimize within 0.25 to 0.75 percent range for drainage.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects layout of repository.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Earlier layouts of the repository and Exploratory Studies Facility (ESF) had much steeper drift and ramp grades, which make for less safe operations and preclude use of conventional rail equipment for haulage and transportation. These grades provide for safer operation, regardless of the transport method, and allow use of conventional rail transport. Three percent is commonly accepted as the steepest slope on which trains can operate efficiently. The ramps were excavated at grades ≤3 percent as part of the ESF. The east access/service main was excavated as part of the ESF at a grade of 1.35 percent.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 010 **Subject:** Repository Material Handling Equipment

I. STATEMENT OF ASSUMPTION

Repository material handling equipment:

- Supplies: rail transport.
- Excavated Rock: conveyor belt, or conveyor belt variation preferred when practical.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects repository layout and operations.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Current plans are for underground rail transport of waste packages. Also using rail transport for supplies simplifies underground operations. Use of a conveyor belt for transporting excavated materials reduces the underground transportation fleet required and reduces operating costs where excavated opening size and configuration makes use of a conveyor system practical.

This assumption is part of the *Mined Geologic Disposal System Advanced Conceptual Design Report* (B00000000-01717-5705-00027 Rev. 00).

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS-014 **Subject: Shaft Excavation Method**

I. STATEMENT OF ASSUMPTION

Shaft excavation method: Mechanical where practical.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:
( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects shaft size and support methods and also scheduling and sequencing of construction.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Mechanical excavation methods cause the least disturbance to the rock and are analogous to using mechanical excavation methods in drifts and ramps.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 015 **Subject: Ventilated Air Properties**

I. STATEMENT OF ASSUMPTION

Properties of ventilation air:

Standard Density:	1.2 kg/m^3
Thermal Conductivity:	0.02564 W/mK
Heat Capacity:	1.2082 kJ/m^{3}K

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:
( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Used in ventilation system design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Density from *Industrial Ventilation, A Manual of Recommended Practice*, 18th Edition, American Conference of Governmental Industrial Hygienists, 1984, Cincinnati, Ohio, Figure MS 10 in the Metric Supplement in the back of the volume.

Other values from *Fundamentals of Heat and Mass Transfer*, Second Edition, Incroprera and DeWitt, John Wiley and Sons, 1985, page 767 (Table A.4).

All values are for standard temperature and pressure. Values for other temperatures and pressures should be adjusted by consulting Table A.4.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 016 **Subject:** Maximum Underground Air Velocity

I. STATEMENT OF ASSUMPTION

Maximum allowable air velocity in:

Ramps:	7.6	m/s
Ventilation Shaft:	20.3	m/s
Personnel Shaft:	11.7	m/s
Emplacement Drifts during Construction:	3.0	m/s
Exhaust Mains:	10.2	m/s
Service Mains:	7.6	m/s
Waste Handling Main:	7.6	m/s
Ductwork:	30.5	m/s

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:
( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Used in ventilation system design. May affect excavated dimensions.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Emplacement drift values are from *Mine Ventilation and Air Conditioning*, Second Edition, Hartman, Mutmansky, and Wang, John Wiley and Sons, 1982, page 394.

Ductwork values are from *Tunnel Engineering Handbook*, Bickel and Kuesel, Van Nostrand Reinhold Company, 1982, page 529.

All other values are from the *Site Characterization Plan Conceptual Design Report*, Section 3.4.4, Table 3-23.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 017 **Subject: Minimum Underground Air Velocity**

I. STATEMENT OF ASSUMPTION

Minimum required air velocity in:

	(For Active Excavation)	(For Development Maintenance)
Ramps:	0.51 m/s	0.31 m/s
Shafts:	0.51 m/s	0.31 m/s
Emplacement Drifts:	0.51 m/s	0.31 m/s
Exhaust Mains:	0.51 m/s	0.31 m/s
Service Mains:	0.51 m/s	0.31 m/s
Waste Handling Main:	0.51 m/s	0.31 m/s
Ductwork:	12.7 m/s	10.2 m/s

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:
( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Used in ventilation system design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Ductwork value from *Industrial Ventilation, A Manual of Recommended Practice*, 18th Edition, American Conference of Governmental Industrial Hygienists, 1984, Cincinnati, Ohio, Table 4-2.

All other values are from engineering judgment.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 018 **Subject: Minimum Underground Air Volume**

I. STATEMENT OF ASSUMPTION

Minimum required air volume per:

Diesel kW:	0.0791 (m^3/s)/kW
Underground Worker:	0.0944 (m^3/s)/person

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:
( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects ventilation system design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Both values from *Repository Underground Ventilation System Concepts*, September 1993, Sections 5.2.1 and 5.2.2, DI B00000000-01717-5705-00003, Rev. 00. See it for additional sources such as 29 CFR 1926 and 30 CFR.

These are universally accepted values.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 019 **Subject: Maximum Underground Air Temperatures - Emplacement Drifts**

I. STATEMENT OF ASSUMPTION

Maximum allowable air temperature in emplacement drifts during:

Construction:	27° C effective
Emplacement:	50° C dry-bulb, only in portion requiring access
Caretaker:	no limit, determined by rock temperature
Retrieval:	50° C dry-bulb, only in portion requiring access
Backfilling:	50° C dry-bulb

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:
( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects ventilation system design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Construction effective temperature from *Mine Ventilation and Air Conditioning*, Section 20-5, Second Edition, by H. L. Hartman, J. M. Mutmansky and Y. J. Wang, published by John Wiley and Sons, Inc., 1982. Effective temperature is the most popular empirical heat-stress index that refers the combined effect of temperature, humidity, and velocity of the air to a single empirical temperature scale reflecting equal sensations of warmth or cold. Effective temperature in working spaces can be determined using standard effective temperature charts.

Emplacement and retrieval from *Site Characterization Plan Conceptual Design Report* (SCP CDR), page 2-65. The low temperature is needed only in portions where equipment must operate. It is not necessary to cool the entire drift for access to a small portion.

There may be no ventilation in the emplacement drifts during the caretaker period. If there is no ventilation, the air temperature will be the same as the rock surface temperature.

Temperatures for retrieval and backfilling apply only to drifts being prepared for retrieval or backfilling, or to drifts in which these activities are actively occurring. After emplacement has been completed in a drift and through repository closure, the drift is considered to be in the caretaker period, except for when it is undergoing retrieval or backfilling.

Assumption Identifier: DCSS 019 (continued)

Subject: Maximum Underground Air Temperatures - Emplacement Drifts

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 020 **Subject:** Maximum Underground Air Temperatures - Access Mains

I. STATEMENT OF ASSUMPTION

Maximum allowable air temperature in access (ventilation intake) mains during:

Construction:	27° C effective
Operations:	27° C effective
Caretaker:	27° C effective
Retrieval:	27° C effective
Backfilling:	50° C dry-bulb

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:
( ) Surface, (X) Subsurface, (X) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects ventilation system design and operation of other equipment.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Construction, operation, caretaker and retrieval temperatures from *Mine Ventilation and Air Conditioning*, Section 20-5, Second Edition, by H. L. Hartman, J. M. Mutmansky and Y. J. Wang, published by John Wiley and Sons, Inc., 1982. Effective temperature is the most popular empirical heat-stress index that refers the combined effect of temperature, humidity, and velocity of the air to a single empirical temperature scale reflecting equal sensations of warmth or cold. Effective temperature in working spaces can be determined using standard effective temperature charts.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 022 **Subject: "K" Factor for Ventilation Air Flow**

I. STATEMENT OF ASSUMPTION

"K" factor for ventilation air flow in:

Shafts:	Ventilation Shaft	0.0030 kg/m^3 "A"
	Man-and-Material Shaft	0.0176 kg/m^3 "B"
Ramps:	Waste Ramp	0.0056 kg/m^3 "C"
	Tuff Ramp	0.0111 kg/m^3 "D"
Exhaust Mains:		0.0111 kg/m^3 "D"
Service Mains:		0.0130 kg/m^3 "E"
TBM Launch Mains:		0.0130 kg/m^3 "E"
Waste Main:		0.0111 kg/m^3 "D"
Emplacement Drifts		
	Without Waste Packages:	0.0130 kg/m^3 "E"
	With Waste Packages:	0.0158 kg/m^3 "F"
Metal Ventilation Duct		0.0039 kg/m^3 "G"

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:
( ) Surface, (X) Subsurface, ( ) Waste Package Development, (X) Other (specify):

Need for assumption (statement of intended use):

Affects ventilation system design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

"A" SCP/CDR, page C-16, for smooth lined unobstructed shaft.
"B" SCP/CDR, page C-159, for lined shaft with two sets of buntons.
"C" SCP/CDR, page C-158, for straight unobstructed tunnel in sedimentary rock.
"D" SCP/CDR, page C-158, for straight slightly obstructed tunnel in sedimentary rock.
"E" SCP/CDR, page C-158, for straight moderately obstructed tunnel in sedimentary rock.
"F" Engineering judgment assuming heavily obstructed tunnel.
"G" Preliminary measurement of 1.67 m diameter metal duct in Exploratory Studies Facility (ESF) operation.

Shaft descriptions for "A" and "B" are per Site Characterization Plan (SCP)/Conceptual Design Report (CDR), page C-16. Tunnel descriptions for "C" - "F" match those for maximum values in Table 6-1 in *Mine Ventilation and Air Conditioning*, Second Edition, Hartman, Mutmansky, and Wang, John Wiley and Sons, 1982.

Assumption Identifier: DCSS 022 (continued) **Subject:** "K" Factor for Ventilation Air Flow

Rev. 01 corrects a decimal point error.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 023 **Subject: Maximum Preclosure Rock Surface Temperature**

I. STATEMENT OF ASSUMPTION

Maximum allowable preclosure rock surface temperature in:

Shafts:	35° C	- unventilated
Ramps:	35° C	- unventilated
Mains:	50° C	
Emplacement Drifts:	200° C	

Temporary increases in these temperatures are allowed during initial cooling of emplacement drifts for maintenance, performance confirmation, retrieval and backfillings.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:
( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects ventilation system design and operation of other equipment. Affects emplacement drift size and drift, shaft, and ramp stand-off distances from the emplacement areas.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Emplacement drifts based on project position on thermal goals, a thermomechanical limit to maintain drift wall stability, and a need to allow monitoring prior to closure. (See references below.)

Other values originally from Site Characterization Plan (SCP) Table 8.3.2.4-5. Value for "mains" taken as the same as the value for "access drifts" in the SCP. Mains in the current design are comparable to the SCP's access drifts. The temperatures are limited to the unventilated condition because the intent is to limit the temperatures, caused solely by thermal load from the waste package, outside of the emplacement drifts. Subsequent ventilation of the emplacement drifts may temporarily cause the rock surface temperatures in the exhaust mains to rise, which is acceptable.

The temperature limits for mains and emplacement drifts reflect the recommendations of the *Site Characterization Plan Thermal Goals Reevaluation*, DI B00000000-01717-5705-00005 Rev. 00 (CRWMS M&O 1993a). The *Thermal Loading Study for FY 1996*, DI: B00000000-01717-5705-00044 REV 01 (CRWMS M&O 1996g), recommended retention of the 200° C limit for the emplacement drift wall temperature limit.

Assumption Identifier: DCSS 023 (continued) **Subject: Maximum Preclosure Rock Surface Temperature**

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Surface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 025 **Subject: Maximum Zeolite Temperature**

I. STATEMENT OF ASSUMPTION

The temperature at the average top of the zeolite layer beneath the potential emplacement area shall not exceed 90° C. The vertical distance from the emplacement area horizon to the average top of the zeolite layer in the Primary Area is estimated at 170 m.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:
( ) Surface, (X) Subsurface, (X) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects location and extent of repository and also waste package spacing.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

This goal is provided to limit mineralogic conversion of clinoptilolite, with significant sorptive properties for some radionuclides, to analcime, which has poor sorptive properties. Natural analog studies have found that this conversion may take place above 90°to 100°C in J-13 water chemistry. The zeolitized layer within the CHn, as discussed in the Thermal Loading Study for FY 1996 and as defined by the LANL site scale geologic model, is at least 125 m and on average about 170 m below the primary area portion of the potential repository. If alternative emplacement areas are considered, the average depth to the top of the zeolitized layer beneath those areas will need to be estimated. The temperature at this average top depth shall not exceed 90°C. Reference: Thermal Loading Study for FY96, DI: B00000000-01717-5705-00044 Rev. 01.

IV. RESPONSIBILITY/SUBSTANTIATION/WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering Requirements

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 027 **Subject: Rock Support Material Restrictions**

I. STATEMENT OF ASSUMPTION

Organic materials (e.g., epoxy resin, timber) are restricted for use as rock support and other postclosure permanent materials in all openings.

Concrete (subject to restrictions on chemical composition of cementitious materials) and steel are allowable preclosure construction material in all openings.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:
( ) Surface, (X) Subsurface, (X) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects rock support design and possibly other underground work.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

These restrictions are necessary to minimize the impact of subsurface construction on waste isolation. The use of organics and specific cementitious materials should be approved by the Determination of Importance (DI) group. As indicated in Assumption EBDRD 3.2.3.3.A.13, performance evaluations are needed to determine any adverse impacts to waste isolation.

The restriction on the use of concrete include construction of systems, structures, and components that will be removed prior to closure.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 028

Subject: Emplacement Drift, Shafts, Ramps Maintenance Plans

I. STATEMENT OF ASSUMPTION

Emplacement drifts will be designed to be stable through the caretaker period, with the goal to minimize or eliminate planned maintenance to sustain the ability to retrieve, sample, or relocate waste packages. Shafts, ramps, and all other drifts will be designed to be stable, but may rely on periodic planned maintenance.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:
( ) Surface, (X) Subsurface, (X) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects design and cost of openings as well as operations and maintenance.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Based on engineering judgment that long term, periodic maintenance in emplacement drifts is unfeasible. Long term maintenance elsewhere is feasible, and therefore this should allow a more economical design. See Key Assumption 013 for human entry under off-normal conditions.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 029 **Subject:** Maximum Underground Air Temperatures - Exhaust Mains

I. STATEMENT OF ASSUMPTION

Maximum allowable air temperature in exhaust mains during:

Construction:	27° C	effective
Operations:	50° C	dry-bulb
Caretaker:	50° C	dry-bulb
Retrieval:	≤ emplacement drift rock surface temperature	
Backfilling:	50° C	dry-bulb

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:
( ) Surface, (X) Subsurface, (X) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects ventilation system design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Construction effective temperature from *Mine Ventilation and Air Conditioning*, Section 20-5, Second Edition, by H. L. Hartman, J. M. Mutmansky and Y. J. Wang, published by John Wiley and Sons, Inc., 1982. Effective temperature is the most popular empirical beat-stress index that refers the combined effect of temperature, humidity, and velocity of the air to a single empirical temperature scale reflecting equal sensations of warmth or cold. Effective temperature in working spaces can be determined using standard effective temperature charts.

Operations and Caretaker - assumed same as "Maximum Allowable Rock Surface Temperature in Mains" (DCSS 023).

Retrieval - air temperature would normally be no greater than the rock surface temperature (50 degrees C per DCSS 023), but could be as high as the emplacement drift rock surface temperature if the emplacement drifts are ventilated through the exhaust mains.

Backfilling - this temperature is for backfilling within the exhaust mains, during which there is no flow-through ventilation. This is the same as the rock surface temperature (DCSS 023).

Assumption Identifier: DCSS 029 (continued)

Subject: Maximum Underground Air Temperatures - Exhaust Mains

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 030 Subject: Limit Ground Surface Uplift

I. STATEMENT OF ASSUMPTION

Limit surface uplift to less than 0.5 cm/yr and relative motion of the top of TSw1 to less than 1 m with no intact rock failure and no continuous joint slip.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:
( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

These limits appear as goals 3 and 4 in the 1993 *Site Characterization Plan Thermal Goals Reevaluation* report, DI B00000000-01717-5705-00005, Rev. 00.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 031 Subject: Limit Temperatures in PTn

I. STATEMENT OF ASSUMPTION

Limit temperatures in PTn (Upper Paint Brush non-welded) to less than 115° C.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The general goal to establish a thermal limit in the PTn units was recommended in 1993 (*Site Characterization Plan Thermal Goals Reevaluation*, DI B00000000-01717-5705-00005 Rev. 00). No actual values were recommended at that time so a working value equal to that established for the TSw3 (vitrophyre tuff) is established here. The TSw3 temperature limit has since been eliminated, therefore the 115 degrees C value needs to be evaluated during the substantiation process.

Note: This thermal goal has been written in the format of requirement EBDRD 3.7.G so that upon substantiation, it may be captured by the Management and Operating Contractor (M&O) Requirements and incorporated into EBDRD 3.7.G or in the appropriate section of the Repository Design Requirements Document (RDRD).

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Engineering

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 032 **Subject: Temporary Surface Facilities for Underground Construction**

I. STATEMENT OF ASSUMPTION

Underground construction will not use the north portal for access once emplacement operations begin.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects logistics of underground construction and location of construction accesses.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Key Assumption 047 states that the permanent repository surface facilities will be located next to the north portal. The concept of operations has emplacement and development (construction) operations to use separate accesses. Therefore, the north portal cannot be used for construction once emplacement begins. However, this does allow initial development to be carried out using the north portal. Temporary surface facilities for underground construction will be located accordingly.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Surface, Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 033 **Subject:** Emplacement Drift Standoff

I. STATEMENT OF ASSUMPTION

The greater of two standoff distances in the emplacement drifts for thermal and radiological concerns will be utilized for calculating the usable emplacement area as follows:

- A 35 m thermal standoff distance is used to limit the surface rock temperature of the adjacent main drift. This thermal standoff is defined as the perpendicular distance from the center of the closest emplaced waste package to the nearest edge of the main drift.

- A 13 m radiological standoff distance is used for limiting the radiological dose in the adjacent main drift. This radiological standoff is defined as the distance from the center of the closest emplaced waste package to the door of the emplacement drift. This distance is equal to the sum of the distances from the door to the edge of the waste package (10 m) plus half the length of the waste package (approximately 3 m).

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects total useable emplacement area.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

<u>Thermal Standoff</u>

Past Repository layouts, especially the *Site Characterization Plan, Yucca Mountain Site*, have allowed adequate standoff to limit the main drift wall temperature to less than 50° C for the first 50 years after emplacement. Based on previous studies compiled within the *Initial Summary Report for Repository/Waste Package Advanced Conceptual Design*, thermal standoff distances were given for a narrow range of thermal loadings and specific emplacement conditions The thermal loading range in the studies is consistent with the current program thermal loading of 83 MTU/acres. However, the emplacement conditions do not quite match the current repository design. Among the differences are the emplacement mode is now in-drift, the length of time to sustain main drift wall temperature is now 150 years, and continuous ventilation is now considered in the main drifts throughout the period of operations.

Assumption Identifier: DCSS 033 (continued) **Subject: Emplacement Drift Standoff**

Radiological Standoff

A radiological standoff is needed to limit the radiological dose in the adjacent main drift. For current work, the position of the closest emplaced waste package from the door is based on engineering judgement. Preliminary assessment suggests that the selected value is satisfactory provided there is sufficient shielding just inside the door to the emplacement drift as well as outside the door in the turnout for worker protection in the main drift once the emplacement drift is full and closed for caretaker operations. the door to the emplacement drift is at the end of a 25-40 m long turnout (curved section plus straight section) that provides a transition for rail transport from the main drift to the emplacement drift entrance.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 036 **Subject: Emplacement Drift Entrance Doors**

I. STATEMENT OF ASSUMPTION

Doors are required at entrances to emplacement drifts.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, or ( ) Other (specify):

Need for assumption (statement of intended use):

Needed to focus design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Doors at entrances to emplacement drifts serve two purposes: they control access to the emplacement drifts and they provide control of ventilation through the drifts. They will also inherently provide some amount of radiological shielding.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 037 **Subject: Invert Material**

I. STATEMENT OF ASSUMPTION

Invert material will consist of concrete. Other material additives may be used as necessary (refer to Assumption EBDRD 3.2.3.3.A.13). The emplacement drifts with steel sets will contain steel inverts.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, or ( ) Other (specify):

Need for assumption (statement of intended use):

Needed to focus design efforts.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Supports an invert system that is constructable and meets requirements for waste package support and engineered barrier performance. A previous assumption that the invert material would consist of concrete/crushed tuff material combination was abandoned because of cost considerations. See Sections 4.3.3 and 7.2 of *Emplacement Drift Invert Structural Design Analysis*, BBDC00000-01717-0200-00001 REV 00 (CRWMS M&O 1997q).

For the use of steel inverts with steel sets, see drawing *Emplacement Drift Ground Support Steel Sets*, BCAA00000-01717-2700-83020.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 038 **Subject: Air Monitoring Underground**

I. STATEMENT OF ASSUMPTION

Air in underground excavations, including shafts and ramps, will be monitored as required for health, safety, and performance confirmation.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, or ( ) Other (specify):

Need for assumption (statement of intended use):

Needed to focus design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Performance Confirmation monitoring will be required in specified locations throughout the repository. Since the shafts currently are to be used for exhaust air, it is logical to monitor them.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 039 **Subject: Ventilation System Pressure Differential**

I. STATEMENT OF ASSUMPTION

The ventilation systems for the emplacement and development areas shall be designed such that there is a pressure differential from the development to emplacement sides. The pressure in the development area shall be higher than the pressure in the emplacement area by approximately 189-531 Pa (0.76-2.14 inches water gage).

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, or ( ) Other (specify):

Need for assumption (statement of intended use):

Affects ventilation and repository layout designs.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The pressure differential assures that any air leakage will be from the development area to the emplacement area. This reduces the risk of an airborne radioactive particle release into the development area. The pressure differential value is based on practical limitations on the bulkheads to be installed between the development and emplacement areas.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 040 **Subject: Diesel Equipment Limitation**

I. STATEMENT OF ASSUMPTION

The use of diesel powered equipment will not be allowed in the subsurface repository under normal conditions. Its use is not precluded, however, in off-normal events.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, or ( ) Other (specify):

Need for assumption (statement of intended use):

The repository design team must select the primary power source for the subsurface design. Previous work has avoided diesel for the reasons stated below, but no official project position had yet been established prior to this assumption.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The use of diesel engines underground produces emissions which could potentially have a negative impact on long term performance. Diesel particulates (soot) and Oxides of Nitrogen (NO_x) are the chief constituents of concern. The Determination of Importance Evaluation for ESF Design Package 2C, and its accompanying "Waste Isolation Evaluation: Tracers, Fluids, and Materials for Use in the Package 2C Exploratory Studies Facility Construction" contain preliminary evaluations on which early diesel work was based.

Diesel use has been allowed in the ESF on the basis that its use will not materially affect waste isolation because no potential emplacement areas are being excavated in the course of the construction of the ESF. However, it has been assumed by the repository design team that diesel use would not be acceptable for the construction and operation of the repository. This is based on the significantly larger total emissions which would result from construction and 100-year operations in the repository over that expected from construction and operations of the ESF, and the fact that repository airflow paths would include emplacement areas.

Information on this subject is available in the following documents: *Use of NTS Surplus Diesel Locomotives in the Excavation and Operation of the North Ramp of the ESF* and BAB000000-01717-1700-00001 (CRWMS 1994g) and *Diesel Emissions Expected From Deutz F8L413FW Engine During North Ramp Excavation,"* BABEA0000-01717-0200-00001 (CRWMS 1994h).

Assumption Identifier: DCSS 040 (continued) Subject: Diesel Equipment Limitation

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCSS 041 **Subject: Subsurface Configuration for Water Drainage**

I. STATEMENT OF ASSUMPTION

The repository subsurface layout will be configured such that:

- Water entering the emplacement drifts can drain, by gravity, out of the emplacement drifts into the mains, and, once out of an emplacement drift, cannot re-enter another emplacement drift. (This assumption does not encompass general flooding of the facility);
- Drifting above the emplacement level will not have direct connection to an emplacement drift such that water entering the over-lying drift could flow by gravity through a man-made opening into the underlying emplacement drifts;
- Drifting above the emplacement level will be configured to slope so that any water which enters the drift can flow, by gravity, away from the emplacement area.

The drainage patterns are shown in drawing *Drainage Patterns VA Design Layout Plan*, BCAA0000-01717-2700-81028.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, or ( ) Other (specify):

Need for assumption (statement of intended use):

The subsurface repository design, including its input to the construction of the Exploratory Studies Facility design, have operated on the above assumption since the development of the Advanced Conceptual Design. It has significant influence on the design and, as such, should be documented in the project assumptions.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The rationale for the guidance stated above is the regulations, in 10CFR60.133 (a)(1), 60.133(d), and 60.133(h) which require the underground facility to aid in the isolation of the wastes. The assumptions above result in a facility which, to the extent practical, minimizes the opportunities for water to contact disposal containers after closure. Water which enters an emplacement drift will drain out by gravity, and is precluded by the layout from flowing, by gravity, into another emplacement drift. Drifts above the emplacement horizon are restricted such that they must slope to allow any water entering them to flow away from the emplacement area. Drifts above the horizon are also constrained in that they must have no direct connection with emplacement drifts which could provide a gravity flow pathway from the overlying drift into the emplacement horizon.

Assumption Identifier: DCSS 041 (continued) **Subject: Subsurface Configuration for Water Drainage**

It is not possible to preclude water contact with containers solely by the layout of the drifts, but the measures above help ensure that the layout does not allow water more than one chance to contact a container, and does not focus flow onto containers which otherwise may not have reached them.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Subsurface

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

SECTION 8

DESIGN CONCEPT WASTE PACKAGE ASSUMPTIONS (DCWP)

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCWP 001 **Subject: Limit Fuel Cladding Temperature**

I. STATEMENT OF ASSUMPTION

Limit the fuel cladding temperature after placement in the waste package to less than 350 degrees C.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, (X) Waste Package Development, (X) Other (specify):
Systems Analysis and Modeling

Need for assumption (statement of intended use):

Performance measure.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The SCP established this thermal goal. It was reevaluated in 1993 and found to be still valid (*Site Characterization Plan Thermal Goals Reevaluation*, DI B00000000-01717-5705-00005, Rev. 00). Note: EBDRD 3.2.3.4.C.2 places a "derived" 350° C maximum temperature requirement on Waste Acceptance so that the: "Temperature will not have exceeded 350° C (TBV) during storage under inert gas." EBDRD 3.2.3.4.C.2 should not be confused with the intent of DCWP-001. DCWP-001 is a long term goal to enhance the Zircaloy cladding performance.

The 350° C value may change as more information is gathered on temperature sensitivity of Zircaloy cladding. Assurance is needed to maintain cladding temperatures to values low enough to enhance the Zircaloy cladding performance as a barrier.

Thermal Loading Study for FY96, DI: B00000000-01717-5705-00044 Rev. 00, recommended retention of the 350° C limit on the cladding temperature.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization:
Systems Engineering (Vienna)

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: DCWP 002 Subject: Limit HLW Glass Temperature

I. STATEMENT OF ASSUMPTION

Limit the temperature of the high-level waste (HLW) glass to less than 400° C during storage at the producer sites and during transport to the repository.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, (X) Waste Package Development, (X) Other (specify): Systems Analysis and Modeling

Need for assumption (statement of intended use):

Performance measure.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The Site Characterization Plan (SCP) established this thermal goal to assure that the glass transition temperature is not exceeded. It was reevaluated in 1993 and found to be still valid based on conversations with Savannah River personnel (*Site Characterization Plan Thermal Goals Reevaluation*, DI B00000000-01717-5705-00005 Rev. 00). The goal should be retained for the present with the goal reevaluated when new information is supplied by Savannah River.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Systems Analysis and Modeling

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

SECTION 9

TECHNICAL DATA SURFACE ASSUMPTIONS (TDS)

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: TDS 002 Subject: Topography/Morphology

I. STATEMENT OF ASSUMPTION

The Topographical Survey Data and Surface Morphology shall be as described in Section 1.11 of the Reference Information Base (RIB).

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

This information is needed as input for site layouts

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

This information is taken directly from the Reference Information Base (RIB).

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Natural Environment Program Operations

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: TDS 003 Subject: Soil Properties

I. STATEMENT OF ASSUMPTION

The Soil Properties are described in Sections 1.1311, 1.1312, 1.1313, and 1.1314 of the RIB. The soil hydrologic properties, soil mechanical properties, soil geochemical properties, and soil physical properties are given.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

This information is needed as input into surface facilities layouts, surface facilities structural design, and certain environmental considerations that will be incorporated into the overall design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

This information is taken directly from the Reference Information Base (RIB).

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Natural Environment Program Operations

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: TDS 004 **Subject: Meteorology**

I. STATEMENT OF ASSUMPTION

The Site Meteorology includes data on atmospheric and climatic conditions at the site based on historical data. These conditions are delineated in the *Engineering Design Climatology and Regional Meteorological Conditions Report* (CRWMS M&O 1997n). Long-term postclosure climatic conditions are not derived from this source.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

This information will be used as input into various features of the facilities designs and will impact the operational concepts.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The *Engineering Design Climatology and Regional Meteorological Conditions Report* (CRWMS M&O 1997n) contains the up-to-date (1996) information on regional and site-specific meteorological conditions using data from site-specific meteorological monitoring networks operating in the immediate vicinity of Yucca Mountain and long-term data from regional stations. Annual updates to this report are planned to ensure site-specific climatology is current.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Environmental Field Programs

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: TDS 006 Subject: Design Basis Tornadoes

I. STATEMENT OF ASSUMPTION

The Design Basis Tornado (DBT) will be based on the "Parameters of Design-Basis Tornadoes (DBTs) for NTS," which are given in the Reference Information Base (RIB), Section 1.3b, Table 2.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

The design of nuclear facilities must assure that the designs considers severe natural phenomena.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

- This material came directly from the Reference Information Base (RIB).
- Differences between the RIB and NRC Regulatory guide 1.76, "Design Basis Tornado for Nuclear Power Plants" are to be evaluated for compliance with the NRC regulatory requirements.
- Sandstorm loading is assumed to be bounded by tornado and tornado missile loading and hence are not addressed in a separate CDA assumption.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Environmental Field Programs

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: TDS 007 Subject: Winds (Operating Basis and Standard)

I. STATEMENT OF ASSUMPTION

Extreme-wind speed projections, mean wind speeds, and joint probability distributions (wind speed and direction) from the *Engineering Design Climatology and Regional Meteorological Conditions Report* (CRWMS M&O 1997n) will be used as the basis for repository facility design.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

The Concept of Operations uses this information for such considerations as dust suppression, effluent release calculations, etc.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The *Engineering Design Climatology and Regional Meteorological Conditions Report* (CRWMS M&O 1997n) contains up-to-date analysis of wind data collected at site-specific monitoring stations operating in the immediate vicinity of Yucca Mountain and long-term data from regional stations.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Environmental Field Programs

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: TDS 008 **Subject: Floods (Design Basis)**

I. STATEMENT OF ASSUMPTION

The Design Basis Flood shall be based on the Probable Maximum Flood Boundaries identified in Tables 2.6.2-1 and 2.6.2-2 of the *Technical Basis Report for Surface Characteristics, Preclosure Hydrology and Erosion,* Document No.: YMP/TBR-001, Rev. 0.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Drainage areas and peak flood discharges will be factors that will impact the location and layout of the various surface facilities.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

This information governs that which previously was cited in the Reference Information Base (RIB). This report was developed to provide surface characteristics, preclosure hydrology, and erosion at the Yucca Mountain Site, to support evaluation of siting guidelines of 10 CFR Part 960, General Guidelines for the Recommendation of Sites for the Nuclear Waste Repositories.

Differences between YMP/TBR-001 and NRC Regulatory guide 1.59, "Design Basis Floods for Nuclear Power Plants" are to be evaluated for compliance with NRC regulatory requirements.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Natural Environment Program Operations

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: TDS 016 **Subject: Outdoor Air Temperature/Humidity**

I. STATEMENT OF ASSUMPTION

Parameters used to measure outdoor air temperature and humidity conditions for purposes of repository facilities design will be taken from Table A-17 of the *Engineering Design Climatology and Regional Meteorological Conditions Report* (CRWMS M&O 1997n) for the appropriate monitoring site(s) representative of the facility location.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(X) Surface, ( ) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects heating, ventilation, and air conditioning (HVAC) systems design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Table A-17 in Appendix A of the *Engineering Design Climatology and Regional Meteorological Conditions Report* (CRWMS M&O 1997n) provides climatology data summaries in the form recommended by the American Society of Refrigeration, Heating, and Air Conditioning Engineers (ASRAE) for use in design of HVAC systems. The table includes the data summary for each of nine sites operated by the M&O Contractor's Radiological and Environmental Field Programs Department (R/EFPD) to collect environmental and climatic data in the Yucca Mountain vicinity. R/EFPD Site 1 is the closest and most representative of conditions in the north portal area. R/EFPD Sites 3, 4, and 7 are nearby, considered representative of variations in the general vicinity of the north portal due to topography, and thus also appropriate in determining bounding values of ASHRAE parameters for this location.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Environmental Field Programs

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

SECTION 10

TECHNICAL DATA SUBSURFACE ASSUMPTIONS (TDSS)

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: TDSS 001 Subject: In Situ Stress

I. STATEMENT OF ASSUMPTION

Rock in situ stress at proposed repository horizon:

Parameter	Average Value	Range
Vertical Stress	7.0 MPa	5.0 - 10.0 MPa
Min Horiz/Vert Stress	0.5	0.3 - 0.8
Max Horiz/Vert Stress	0.6	0.3 - 1.0
Bearing - Min Horiz Stress	N57W	N50W - N65W
Bearing - Max Horiz Stress	N32E	N25E - N40E

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, or ( ) Other (specify):

Need for assumption (statement of intended use):

Affects repository layout and induced stresses.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

From *Site Characterization Plan Conceptual Design Report* (SCP CDR)

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Natural Environment Program Operations

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: TDSS 002

Subject: Ground Surface Temperature, Rock Thermal Gradient

I. STATEMENT OF ASSUMPTION

Average rock temperature at ground surface: 18.7° C.

Thermal gradient in rock: 0.020°C/m for depth 0 to 150 m
0.018° C/m for depth 150 to 400 m
0.030° C/m for depth 400 to 541 m

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects repository rock temperature from thermal loading and ventilation system design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

From Reference Information Base (RIB), Rev. 03 ICN 1, Section 1.1326a, text on page 4 and Figure 4 on page 20, which is based on temperature profile in USW G-4.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Natural Environment Program Operations

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: TDSS 003 Subject: TSw2 In Situ Saturation

I. STATEMENT OF ASSUMPTION

In situ degree of saturation (percent) for subunits of Tsw2:

Middle nonlithophysal (Tptpmn or TMN)	92
Lower lithophysal (TLL)	83
Mottled, upper 2/3 (TM2)	88
Mottled, lower 1/3 (TM1)	90

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects repository rock temperature from thermal loading and ventilation system design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

For the middle nonlithophysal subunit, a weighted average was calculated from core samples of the Drift Scale Test, Single Heater Test, and the Observation Drift that were collected in ESF subsurface work and documented in tables 5-1, 5-2, 5-3, and 5-4 of *Ambient Characterization of the Drift Scale Test Block*, BADD0000-01717-5705-00001 REV 01, CRWMS M&O, December 1997. For the other subunits, averages were calculated from mean saturation data for individual boreholes, as extracted from Table 9 of *Characterization of Hydrogeologic Units Using Matrix Properties, Yucca Mountain, Nevada* (Flint, Lorraine E. 1998).

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Natural Environment Program Operations

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: TDSS 004 Subject: TSw2 Rock Densities

I. STATEMENT OF ASSUMPTION

Average TSw2 density is 2274 kg/m^3.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Basic parameter for rock mechanics design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Value from Exploratory Studies Facility (ESF) Ground Support Analysis, BABEE0000-01717-0200-00002, REV 00, Table V-1. Value is mean of dry density at in situ degree of saturation.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Natural Environment Program Operations

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: TDSS 005 **Subject: TSw2 Thermal Conductivity**

I. STATEMENT OF ASSUMPTION

Thermal conductivity of rock mass (dry and in situ saturation) - TSw2: 2.1 W/mK.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects repository rock temperature from thermal loading and ventilation system design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Mean value from Reference Information Base (RIB), Rev. 03, Section 1.1326a, Table 2. See Reference Information Base (RIB) for variability.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Natural Environment Program Operations

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: TDSS 006

Subject: TSw2 Heat Capacitance

I. STATEMENT OF ASSUMPTION

Heat capacitance of in-situ rock - TSw2:

2.0324×10^6 J/m^{3}K @ 25°C
2.1280×10^6 J/m^{3}K @ 50°C
2.2638×10^6 J/m^{3}K @ 94°C
10.7683×10^6 J/m^{3}K @ 95°C
10.4690×10^6 J/m^{3}K @ 105°C
10.1984×10^6 J/m^{3}K @ 114°C
2.0065×10^6 J/m^{3}K @ 115°C
2.1114×10^6 J/m^{3}K @ 155°C
2.1912×10^6 J/m^{3}K @ 195°C
2.2692×10^6 J/m^{3}K @ 235°C
2.3410×10^6 J/m^{3}K @ 275°C

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects repository rock temperature from thermal loading and ventilation system design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

From Reference Information Base (RIB), Rev. 03, Section 1.1326a, Table 6. Rev. 00 of this document added values for a wider temperature range.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Natural Environment Program Operations

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: TDSS 007 **Subject: TSw2 Thermal Expansion**

I. STATEMENT OF ASSUMPTION

Thermal expansion coefficient of in situ rock during heating - TSw2:

5.07×10^{-6}/° C @	25 -	50°C
7.30×10^{-6}/° C @	50 -	100°C
8.19×10^{-6}/° C @	100 -	150°C
8.97×10^{-6}/° C @	150 -	200°C

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects repository rock temperature and stress from thermal loading and ventilation system design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Values are averages of the mean values for TSw2 from Tables 2-10, 2-11, and 2-12 in *Repository Design Data: Update Through August 1995* (SNL 1995c).

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Natural Environment Program Operations

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: TDSS 008

Subject: TSw2 Elastic Modulus

I. STATEMENT OF ASSUMPTION

Elastic modulus of rock mass - TSw2 (at ambient temperature).

Rock Mass Quality Category	Elastic Modulus (GPa)
1	6.37
2	8.96
3	12.55
4	17.11
5	23.51

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Needed for stress and deformation calculations of rock mass.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Values from Sandia National Laboratories *Data Transmittal for Rock Mass Mechanical Properties Estimates from NRG Drilling Program*, TDIF 304414, DTN: SNF29041993002.062, June 1995.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Natural Environment Program Operations

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: TDSS 009 **Subject: TSw2 Poisson's Ratio**

I. STATEMENT OF ASSUMPTION

Poisson's ratio (at ambient temperature):

Intact Rock - TSw2: 0.21
Rock Mass - TSw2: 0.21

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Needed for stress and deformation calculations of rock mass.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Values from Sandia National Laboratories *Data Transmittal for Rock Mass Mechanical Properties Estimates from NRG Drilling Program*, TDIF 304414, DTN: SNF29041993002.062, June 1995.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Natural Environment Program Operations

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: TDSS 010 Subject: TSw2 Uniaxial Compressive Strength

I. STATEMENT OF ASSUMPTION

Uniaxial compressive strength of intact rock - Tsw2: 155 MPa (at ambient temperature).

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Needed for stress and deformation calculations of rock mass.

Basic parameter for rock mechanics design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Mean value from Reference Information Base (RIB), Rev. 03, Section 1.1322a, Table 1. See Reference Information Base (RIB) for variability.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Natural Environment Program Operations

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: TDSS 011 Subject: TSw2 Mohr-Coulomb Strength Parameters

I. STATEMENT OF ASSUMPTION

Mohr-Coulomb strength parameters of rock mass - TSw2 (at ambient temperature):

Rock Mass Quality Category	Cohesion (MPa)	Friction Angle (Degrees)
1	1.3	49
2	1.6	49
3	2.2	50
4	2.8	50
5	3.8	50

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Needed for evaluation of stability of rock structure.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Values from Sandia National Laboratories *Data Transmittal for Rock Mass Mechanical Properties Estimates from NRG Drilling Program*, TDIF 304414, DTN: SNF29041993002.062, June 1995.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Natural Environment Program Operations

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: TDSS 012 Subject: TSw2 Porosity

I. STATEMENT OF ASSUMPTION

Porosity of intact rock - TSw2: 0.121.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

(-) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):_)

Need for assumption (statement of intended use):

Needed to calculate rate at which water is absorbed or removed from rock. Affects thermal calculations and ventilation system design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Mean value from Reference Information Base (RIB), Rev. 03, Section 1.1321a, Table 1. See Reference Information Base (RIB) for variability.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Natural Environment Program Operations

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: TDSS 017 Subject: Rock Joint Orientation and Frequency

I. STATEMENT OF ASSUMPTION

Rock joint orientation:

	Strike	Dip
Major Joint Set	N10 - 12W	75 - 90 NE/SW
Minor Joint Sets	N25E	10SE
	N - N45E	80 - 90 SE/NW

Rock joint frequency: TSw2: 2.51/m for 70-80 degree joints, 11.28/m for 80-90 degree joints (mean value)

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Needed for rock mass stability and deformation calculations.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

From Lin et al., SNL SAND92-0449, Table 3-9.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Natural Environment Program Operations

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: TDSS 021 **Subject: Surface Air Temperature/Humidity**

I. STATEMENT OF ASSUMPTION

Parameters used to measure surface air temperature and humidity conditions for purposes of subsurface facilities design will be taken from Table A-17 of the *Engineering Design Climatology and Regional Meteorological Conditions Report* (CRWMS M&O 1997n) for the appropriate monitoring site(s) representative of the air intake location. (This is the same data indicated in assumption TDS 016 for use as the basis for surface facility design.)

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects underground ventilation and cooling system design.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

Table A-17 in Appendix A of the *Engineering Design Climatology and Regional Meteorological Conditions Report* (CRWMS M&O 1997n) provides climatology data summaries in the form recommended by the American Society of Refrigeration, Heating, and Air Conditioning Engineers (ASRAE) for use in design of HVAC systems. The table includes the data summary for each of nine sites operated by the M&O Contractor's Radiological and Environmental Field Programs Department (R/EFPD) to collect environmental and climatic data in the Yucca Mountain vicinity. R/EFPD Site 1 is the closest and most representative of conditions in the north portal area. R/EFPD Sites 3, 4, and 7 are nearby, considered representative of variations in the general vicinity of the north portal due to topography, and thus also appropriate in determining bounding values of ASHRAE parameters for this location.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Environmental Field Programs

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: TDSS 022 Subject: Wind Intensity

I. STATEMENT OF ASSUMPTION

Wind intensity for subsurface facility design will be based on the same data indicated in assumption TDS 007 for use as the basis for surface facility design.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, (X) Subsurface, ( ) Waste Package Development, ( ) Other (specify):

Need for assumption (statement of intended use):

Affects design of ventilation exhaust system.

III. RATIONALE

Rationale for assumption (source author, date, and report title) or statement of reasoning behind engineering judgment:

The *Engineering Design Climatology and Regional Meteorological Conditions Report* (CRWMS M&O 1997n) contains up-to-date analysis of wind data collected at site-specific monitoring stations operating in the immediate vicinity of Yucca Mountain and long-term data from regional stations.

IV. RESPONSIBILITY AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Environmental Field Programs

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: TDSS 025 **Subject: Unsaturated Zone Groundwater Chemistry**

I. STATEMENT OF ASSUMPTION

The composition of seeping water (per Assumption TDSS 026) that enters the excavated volume of the repository is:

Typical: pH 7.4 (J-13)
Variability: pH 4.5 to 10.5
Concentration factor of 0.1 to 10 times the nominal J-13

These variabilities of the water chemistry are applicable to the water influx at the edge of the excavated volume.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( ) Surface, ( ) Subsurface, ( ) Waste Package Development, or (X) Other (specify): Natural Environment Program Operations

Needed to determine waste package corrosion rates.

III. RATIONALE

The following rationale describes the basis for the assumed values of the water chemistry presented in this assumption. A formal request was submitted to the Natural Environment Program Operations to obtain qualified data from which to refine these values.

Since the repository horizon is well above the saturated zone, the source of seeping water is presumably precipitation (rainwater). As the water (i.e., aqueous solution) percolates through the soil and rock, its composition gradually changes from that of rainwater to that of J-13.

J-13 well water has been extracted from TSw2 in the saturated zone, east of Yucca Mountain, so its composition should be indicative of the composition of groundwater at the TSw2 repository horizon. The composition of J-13 has been published in Reference 1 (pg. 38, Table 3-2). Compositions of typical rainwater have also been published in Reference 2 (pg. 165, Table 38). Comparison of the compositions cited above shows that, for each reported constituent, rainwater is more dilute than J-13 well water. Since dissolved constituents generally increase the corrosion capabilities of water, and since the composition of the percolating groundwater is progressing from the dilute composition of rainwater to the more concentrated composition of J-13 groundwater in the saturated zone, it is conservative to assume that the seeping water that enters the excavated volume has the composition of J-13 well water. It is noted that the excavated volume, rather than the emplacement drift, is specified because a concrete drift lining, if used, may significantly affect the composition of the groundwater.

Assumption Identifier: TDSS 025 (continued) **Subject: Unsaturated Zone Groundwater Chemistry**

Because of local effects, the composition of water in some very localized environments (e.g., in a corrosion pit, under a microbial colony, after interactions with the engineered barrier system, with the waste package, or with any cementitious materials in the drift) may be more concentrated in some species.

The water involved in steady state ambient flow and especially the thermally induced mobilized flow will have more opportunities to be chemically altered than the episodic ambient flow. This is a very complex process to understand and predict. Estimates are being provided in this assumption to cover the expected range of variability for those chemical properties that may have the largest potential to impact the engineered barrier design. These parameters are the water pH and the ionic concentration. Effects from major microbial activity and/or acidic divergence could lower the pH (Reference 3). A conservative estimate is a pH of 4.5. The results from the calculations in Reference 4, indicate that pH values can change in the alkaline regions from 7 to 10.5. The dynamic nature of the heating and cooling of the rock surrounding the emplacement drifts could also contribute to increased concentration of ions in the water by boiling off part of the water as it travels through the rock. This increase in concentration is conservatively being assumed as a factor of 10. Under conditions such as the episodic flow, the travel path of the water to the excavated openings is relatively direct and quick and therefore the ionic concentration of condensate may be more dilute than J-13. This is being assumed to be one tenth of the concentration of the measured J-13 ionic concentration (References 5 and 6).

References:

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Assumption Identifier: TDSS 025 (continued) **Subject: Unsaturated Zone Groundwater Chemistry**

IV. RESPONSIBILITIES AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Natural Environment Program Operations

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

Controlled Design Assumption
Assumption Rationale Sheet

Assumption Identifier: TDSS 026 **Subject: Bounding Water Percolation**

I. STATEMENT OF ASSUMPTION

The amount of liquid water that percolates downward, and is potentially available to seep into the emplacement drift in the vicinity of one waste package can be estimated in several ways. The following assumptions provide design-basis flow conditions. The ambient (naturally existing) flow rates are developed for the present day conditions (up to 100 years after initial emplacement of waste), near-term conditions (up to 300 years after initial emplacement) and long term conditions (up to 20,000 years after initial emplacement). A separate estimate of flow for drainage design is provided. In addition, the assumption provides the anticipated flow for thermally mobilized water. Design calculations should include the sum of the mobilized and ambient water flow (either the fully mediated, the steady focused or the episodic focused). The assumptions are as follows:

Ambient Fully Mediated (steady in time and uniform in space) Flow: (in the vicinity of one waste package)

Present-day: 0.05 m^3/year

Near-term: 0.1 m^3/year

Long-term: 0.5 m^3/year

Ambient Steady Focused (steady in time and focused in space) Flow: (on average, the engineered barrier system in the vicinity of a waste package will be exposed to such a flow once every 40 years)

Present-day: 2 m^3 of water, occurring over one year

Near-term: 4 m^3 of water, occurring over one year

Long-term: 20 m^3 of water, occurring over one year

Ambient Episodic Focused (episodic in time and focused in space) Flow: (on average, the engineered barrier system in the vicinity of a waste package will be exposed to such a flow once every 40 years)

Present-day: 2 m^3 of water, occurring over one week, one time in the year

Near-term: 4 m^3 of water, occurring over one week, one time in the year

Long-term: 20 m^3 of water, occurring over one week, one time in the year

Assumption Identifier: TDSS 026 (continued) **Subject:** Bounding Water Percolation

Drainage flow:

Present-day: 0.2 m^3/m of drift occurring over one week, one time per year
Near-term: 0.4 m^3/m of drift occurring over one week, one time per year
Long-term: 2 m^3/m of drift occurring over one week, one time per year

Mobilized flow (for present-day, near-term and long-term):

60 m^3/year from emplacement to 30 years for a line load design or to 300 years for a point load design.

II. BACKGROUND

Requesting Management and Operating Contractor (M&O) organization:

( )Surface, ( ) Subsurface, ( ) Waste Package Development, or (X) Other (specify): Program Chief Scientist

Need for assumption (statement of intended use):

Needed for repository and waste package design to respond to percolating water potentially available to seep into the emplacement drifts.

III. RATIONALE

The following rationale describes the basis for the assumed flows presented in this assumption. A formal request was submitted to the Natural Environment Program Operations is being prepared to obtain qualified data from which to refine these flow values.

The unsaturated zone at Yucca Mountain is composed of a sequence of variably-welded and variably-fractured tuff units, distinguishable in terms of their average flow properties: in descending order from the surface, these include the Tiva Canyon welded (TCw) and the Paintbrush nonwelded (PTn) units, and proposed repository host rock, the Topopah Spring welded (TSw) unit. Water reaching the TSw unit percolates downward to it from the surface through the overlying units. The percolation flux in the TSw unit itself is difficult to determine. It cannot be measured directly and only inferred from indirect lines of evidence. The rock is highly heterogeneous and the nature of flow in the unsaturated zone is chaotic and nonlinear, making such inference extremely difficult. Nevertheless, studies to date provide information that can be used to estimate a reasonable bound to the flow conditions that might affect the engineered barrier system.

Assumption Identifier: TDSS 026 (continued) **Subject: Bounding Water Percolation**

Net infiltration into the TCw unit of water precipitating onto the surface of Yucca Mountain provides an upper boundary condition for the percolation flux. Current evidence suggests that present-day net infiltration averages about 5 mm/year across the site (Reference 1). This evidence also suggests that the infiltration varies significantly across the site. Precipitation at the site is episodic so that net infiltration at any specific location is intermittent, with episodes of higher infiltration occurring in short-duration events over only a few days to a week in any given year. Some estimates suggest that infiltration flux; averaged over the site, could be as much as 30 mm in some years and negligible in other years, under present conditions (Reference 1).

Because precipitation at the surface could increase in the future, net infiltration at the site could also increase. Modeling that accounts for global warming over the next three hundred years (near-term) due to the greenhouse effect suggests net infiltration could be twice present-day averages (Reference 2). In the longer term even greater fluxes might occur. Projections of possible climates in the next 20,000 years (long-term) suggest infiltration could increase by about a factor of 10 over present-day values (Reference 2).

Estimates from a number of different lines of evidence (References 3-7) suggest the percolation flux in the host rock presently averages between 2 and 15 mm/year across the site. This range is consistent with the estimate of present-day net infiltration flux.

Like the net infiltration, the percolation at depth is likely to be variable in both space and time. The PTn unit may provide significant mediation of the flow; however, this has not yet been shown conclusively. Also the possibility of spatial focusing of the flow as it proceeds downward, increasing the percolation flux in different locations at different times, cannot presently be precluded. It is reasonably conservative to assume that the average present-day percolation flux is the same as the average present-day infiltration rate, and that this flow could focus in different locations in the host rock.

This information suggests that the engineered barrier system should be designed to withstand percolation fluxes averaging on the order of 5 mm/year and ranging from near zero to as much as 30 mm/year in the wettest years, if present-day conditions were assumed to continue. Under warming trends over the next few hundred years, average flux could double, with a range of near zero to 60 mm/year. Under longer term changes (over the next 20,000 years), the average percolation flux could increase by a factor of ten (50 mm/year), with a range between near zero and 300 mm/year

Present-day flux is likely to be variable in time with values in some years much different than in others. If the percolation flux reflects the characteristics of the infiltration at the surface, it could also be intermittent within the year, with episodes of duration totaling as much as a week. Increased flux over the next few hundred years and in the longer term may occur because of increased frequency of these episodes, because of the increased intensity in individual episodes, or because the nature of the episodes changes (e.g. episodes of precipitation dominated by rainfall changing to those dominated by snow fall). For the purpose of design two cases should be considered: one in which

the flow is steady in flowing years and one in which the flow is episodic within the flowing years, with durations lasting seven days in those years.

The above flux estimates can be used to derive conservative design basis flows for the engineered barrier system. For engineered barriers of 10 m^2 cross-sectional area and for flow that is fully mediated such that the flux is uniform across the repository and constant in time, the average flow contacting the portion of the engineered barrier system associated with a single waste package would be 0.05 m^3/year (5 mm/year x 10 m^2 = 0.05 m^3/year). However, if the flow focuses, a greater amount of water could intersect the engineered barrier system associated with a single waste package. At an areal mass loading of 85 MTHM/acre, the average area of host rock allocated to each waste package is about 400 m^2. If all of the flow occurring in that area were in fact concentrated, as much as 2 m^3 (5 mm/year x 400 m^2 = 2 m^3/year) could intersect the portion of the engineered barrier system associated with a single waste package if that water all focused to that location. This flow could be constant in time or could be episodic, for example, with a duration of one week out of the year. Since the waste package area is about 1/40 of the area collecting the flowing water, each engineered barrier system region associated with a waste package should be exposed to focused flow about once every 40 years.

A greater design-basis flow should be considered for an engineered barrier system designed for longer-term conditions. In the near-term case, the average annual exposure could be as much as 0.1 m^3/year (10 mm/year x 10 m^2 =0.1 m^3/year) and for focused flow 4m^3/year (10 mm/year x 400 m^2 = 4 m^3/year) . For systems designed for long-term periods (on the order of 20,000 years), the design basis should consider an average flow of 0.5 m^3/year (50 mm/year x 10 m^2 = 0.5 m^3/year) and a focused flow of 20 m^3 of water per year (50 mm/year x 400 m^2 = 20 m^3/year).

The ambient flow values presented in this assumption are based on the average flux for that time period and a specific ambient condition. The year to year variation in annual flux can be from near zero to as much as six times the average value utilized in this assumption. The following table presents the range of low and high flow values that correspond to the year to year variations in flux values.

The ambient flow calculations described above account for time- and space-averaged fluxes, the year to year variations of those fluxes (as shown in the "range" table), the long term variation of those fluxes ("present-day", "near-term" and "long-term" cases), steady spatial focusing of the flux into a few fractures, and episodic spacial-focusing of the flux into a few fractures. The variation not included is the spatial variation of average flux across the footprint. This variation is between near zero to a factor of five times the average infiltration flux (Reference 1). It is not known how the variation transfers to percolation flux at depth, because the PTn unit has properties which can mediate, divert, or focus the flow, depending on the behavior of the fractures.

The drainage system should also be designed to withstand flows of water from such episodes. For a 5.5-m wide drift, a drainage system designed for present-day conditions should be capable of handling wet year ephemeral flows amounting to as much as 0.2 m^3 of water per meter of drift

(30 mm/year x 5.5 m drift width = 0.165 m^3/m, rounded to 0.2 m^3/m) occurring over periods totaling one week. This quantity should be increased by a factor of 2 for a system designed to last three hundred years and by a factor of 10 for one designed to be effective on the order of 20,000 years.

Range of Ambient Flow Values

Flow Condition	Flow Values (m^3 / year)	
	Minimum	Maximum
Ambient Fully Mediated		
Present-day	near zero	0.3
Near-term	near zero	0.6
Long-term	near zero	3
Ambient Steady Focused		
Present-day	near zero	12
Near-term	near zero	24
Long-term	near zero	120
Ambient Episodic Focused		
Present-day	near zero	12
Near-term	near zero	24
Long-term	near zero	120

The flow conditions could be modified by the heat generated by the waste. Model simulations for nominal percolation fluxes and areal loading of 85 MTHM/acre (Reference 8) estimate that as much as 500 mm/year of water may be mobilized at a location 3 m above the drift. This mobilization is estimated to persist for a few decades for line loading and a few centuries for point loading. It is possible that little of this mobilized water would flow into emplacement drifts. Nevertheless, for conservative design purposes, it is prudent to assume that such mobilization generates flow into drifts of this magnitude. Assuming that the mobilized water over the area from twice the drift diameter in each dimension focuses on to each engineered barrier system region associated with a waste package, the design basis for thermally perturbed conditions would consider an additional increment of water during the mobilization period of 60 m^3 each year (500 mm/year x 11 m x 11 m = 60 m^3). The applicable period would be several decades for line loading of the waste packages and several centuries for point loading.

Assumption Identifier: TDSS 026 (continued) **Subject: Bounding Water Percolation**

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IV. RESPONSIBILITIES AND WITHDRAWAL

Responsible Management and Operating Contractor (M&O) organization: Natural Environment Program Operations

Document(s) Supporting Withdrawal of Assumption:

Withdrawal Date:

SECTION 11

CONCLUSIONS

11. CONCLUSIONS

The descriptions of the functional analysis and the concept of operations for the Mined Geologic Disposal System were removed from the Controlled Design Assumptions Document in Revision 04. The functional analysis and concept of operations are now documented in the *Mined Geologic Disposal System Functional Analysis Document* (CRWMS M&O 1996b) and the *Mined Geologic Disposal System Concept of Operations* (CRWMS M&O 1997p). Also, the appropriate prior assumptions were either withdrawn or updated, and new assumptions have been added to capture current design concepts.

SECTION 12

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12. REFERENCES

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APPENDIX A

ASSUMPTION STATUS LOG

Controlled Design Assumption
Assumption Status Log
As of Revision 05
Key Assumptions

Assumption Identifier	Assumption Subject	Responsible Organization (for active assumptions)	Status (New, Revised, Unchanged, Withdrawn)
Key 001	Cask Arrival Scenario	SE	R
Key 002	Waste Form Arrival Scenario	SE	R
Key 003	Waste Package Emplacement Scenario	SE	R
Key 004	Average Thermal SNF Characteristics	SE	R
Key 005	HLW and DOE SNF	SE	R
Key 006(W)	MGDS Waste Receipt Period	--	U
Key 007(W)	No MPC Repackaging for Heat Load Tailoring	--	U
Key 008	No Rod Consolidation	WP	U
Key 009	Burnup Credit	WP	U
Key 010(W)	Subsurface WP Transport	--	W
Key 011	Horizontal In-Drift Emplacement	SS	R
Key 012(W)	Use of Robotics	--	U
Key 013	No Human Entry in Emplacement Drifts Containing Waste Packages	SS	U
Key 014(W)	Preclosure Monitoring Activities - Robotics	--	U
Key 015(W)	Remote Handling Systems	--	U
Key 016	Retrievability Period	SE	U
Key 017	Reasons for Retrieval	SE	U
Key 018(W)	Storage of Retrieved Packages	--	U
Key 019	Mass Loading Range	SE	U

Controlled Design Assumption
Assumption Status Log
As of Revision 05
Key Assumptions

Assumption Identifier	Assumption Subject	Responsible Organization (for active assumptions)	Status (New, Revised, Unchanged, Withdrawn)
Key 020(W)	Thermal Load Decision Date	--	U
Key 021(W)	Performance Confirmation Areas for Thermal Loads	--	U
Key 022	Repository Horizon	SS	U
Key 023	Subsurface Fault Standoff	SS	R
Key 024	Site-Generated Wastes	SE, S	R
Key 025(W)	--	--	U
Key 026(W)	--	--	U
Key 027(W)	Mechanical Tunnel Excavation	--	W
Key 028(W)	Tunnel Drill-and-Blast Option	--	W
Key 029(W)	Technical Baseline Change (Remove Rod Consolidation)	--	U
Key 030	Underground Transport of Personnel and Supplies	SS	U
Key 031	Waste Package Shielding	SE	U
Key 032(W)	--	--	U
Key 033(W)	Individual Waste Package Shielding	--	U
Key 034(W)	--	--	U
Key 035(W)	--	--	U
Key 036(W)	Substantially Complete Containment (10 CFR 60.113)	--	U
Key 037(W)	Expected Waste Package Lifetime	--	U
Key 038(W)	Waste Packages Breached at 1000 Years	--	U

Controlled Design Assumption
Assumption Status Log
As of Revision 05
Key Assumptions

Assumption Identifier	Assumption Subject	Responsible Organization (for active assumptions)	Status (New, Revised, Unchanged, Withdrawn)
Key 039	Criticality Control Period	SE	U
Key 040(W)	Period of Waste Isolation	--	U
Key 041(W)	Receipt and Emplacement Rates	--	U
Key 042(W)	Waste Package Materials - High Thermal Load	--	U
Key 043(W)	Waste Package Materials - High Thermal Load	--	U
Key 044(W)	--	--	U
Key 045(W)	Alternative Waste Package Materials	--	U
Key 046	Backfill in Emplacement Drifts	SE	R
Key 047	Surface Facilities Location	S	R
Key 048(W)	Aluminum Boron in First MPC Procurement	--	U
Key 049(W)	Aluminum Boron not Acceptable Long Term	--	U
Key 050(W)	MPC Redesign in Second Procurement	--	U
Key 051(W)	First MPC Procurement Delivery Schedule	--	U
Key 052(W)	Addition of Filler Material at the Repository	--	U
Key 053	Off-Normal Waste Handling	S	R
Key 054(W)	Normal Waste Handling Building Capability (No Filler Material)	--	U
Key 055	Retrieval Demonstration	SS	U
Key 056(W)	Interim Fuel Storage	--	U
Key 057	Burnup or Thermal Measurement	SE	U

Controlled Design Assumption
Assumption Status Log
As of Revision 05
Key Assumptions

Assumption Identifier	Assumption Subject	Responsible Organization (for active assumptions)	Status (New, Revised, Unchanged, Withdrawn)
Key 058	Transportation Mode/Route Within Nevada	WA&T	R
Key 059	MGDS Configuration Item Organization	SE (Requirements)	U
Key 060	Interim Postclosure Standard	SE	R
Key 061	Performance Confirmation Requirements (1996)	SE	R
Key 062(W)	DOE SNF	--	U
Key 063	Waste Package Destructive Testing	SE	U
Key 064	Seismic Design Criteria	SE	R
Key 065	Retrieval Design	S	U
Key 066	Gantry Emplacement and Pedestal Support	SS	R
Key 067	Emplacement Drift Ventilation	SS	U
Key 068	Use of North Ramp for Waste Transport	SS	R
Key 069	Applicability of MSHA and OSHA	SS	U
Key 070	Excavated Opening Diameters	SS	R
Key 071	Preclosure Controlled Area Boundary	S	R
Key 072(W)	Repository Subsurface Layout	--	W
Key 073	No Filler Material	WP	U
Key 074	Waste Package Not Breach for 3,000 years	SE	R

Controlled Design Assumption
Assumption Status Log
As of Revision 05
Key Assumptions

Assumption Identifier	Assumption Subject	Responsible Organization (for active assumptions)	Status (New, Revised, Unchanged, Withdrawn)
Key 075	Water Not Contact Waste Package for 10,000 years	SE	R
Key 076	Multiple Barriers	WP, SS	U
Key 077	Waste Package and Drift Spacing	SS	U
Key 078	Waste Package Loading and Emplacement Order	SS	U
Key 079	Disposal Criticality Analysis Methodology	WP	U
Key 080	Regional Servicing Contractor Interface	SE	R
Key 081	Neutron Absorbers	WP	U
Key 082	LLW Disposal at NTS	ESRP	U
Key 083	Mapping of Repository Subsurface Openings	SE	R
Key 084	Hold Waste during Extended Off-normal Outage	S	R
Key 085	Waste Lifted Vertically	S	U
Key 086	Bounding Navy SNF Canister	WP	U
Key 087	Sealing Requirements	SE	R
Key 088	Plutonium Disposition Materials	SE	N
Key 089	Occupational Exposure Limits	R/EFP, SE	N
Key 090	ALARA Studies	R/EFP, SE	N
Key 091	ALARA Trigger Point	R/EFP, SE	N
Key 092	Commercial SNF Receipts	SE	N

Controlled Design Assumption
Assumption Status Log
As of Revision 05
EBDRD

Assumption Identifier	Assumption Subject	Responsible Organization (for active assumptions)	Status (New, Revised, Unchanged, Withdrawn)
EBDRD 3.1.5.E(W)	Shielding Allocations	–	U
EBDRD 3.2.1.2.C	Preclosure Radiation Exposures and Releases of Radioactive Material	SE	N
EBDRD 3.2.1.4.B	Retrievability Period	SE	N
EBDRD 3.2.1.6.B	Cumulative Releases of Radionuclides for 10,000 Years	SE	N
EBDRD 3.2.2.3	Public Protection	SE	N
EBDRD 3.2.3.1.A.2	Annual Dose Equivalent to Member of the Public	SE	N
EBDRD 3.2.3.1.A.3	Radionuclide Concentrations in Groundwater and Annual Dose	SE	N
EBDRD 3.2.3.1.A.4	Increase in Radionuclide Concentrations in Groundwater	SE	N
EBDRD 3.2.3.3.A.13	Lining and Grouting Material Selection	SS	U
EBDRD 3.2.3.4.C.1.g	SNF Weight	SE	R

Controlled Design Assumption
Assumption Status Log
As of Revision 05
EBDRD

Assumption Identifier	Assumption Subject	Responsible Organization (for active assumptions)	Status (New, Revised, Unchanged, Withdrawn)
EBDRD 3.2.3.4.C.4	Commercial SNF Radionuclide Inventory/Isotopic Concentrations	SE	U
EBDRD 3.2.3.4.C.5	SNF Shipped Dose Rate Limits	SE	U
EBDRD 3.2.3.5(W)	Engineered Barrier/Transportation Physical Interfaces	--	W
EBDRD 3.2.4.5	Shielding	SE	U
EBDRD 3.2.4.6.A	EBS Design Objective for Design Basis Event	SE	R
EBDRD 3.2.5.1.2.B.1	EBS Reliability	SE (Specialty)	U
EBDRD 3.2.5.1.2.B.1.a(W)	Waste Form Reliability	--	U
EBDRD 3.2.5.1.2.B.1.b(W)	Waste Container Reliability	--	U
EBDRD 3.2.5.1.2.B.1.c(W)	Waste Package Internal Structure Reliability	--	U
EBDRD 3.2.5.1.2.B.1.d(W)	Waste Package Packing Reliability	--	U

Controlled Design Assumption
Assumption Status Log
As of Revision 05
EBDRD

Assumption Identifier	Assumption Subject	Responsible Organization (for active assumptions)	Status (New, Revised, Unchanged, Withdrawn)
EBDRD 3.2.5.4	EBS Maintainable Preclosure Service Life	SE	U
EBDRD 3.3.3.B	Information on Label for Equipment and Parts	WP	U
EBDRD 3.3.9.A(W)	Government-Furnished Property	--	U
EBDRD 3.3.9.B(W)	Handling of Government-Furnished Property	--	U
EBDRD 3.4.2(W)	Drawings	--	U
EBDRD 3.7.C(W)	Substantially Complete Containment	--	U
EBDRD 3.7.D	Engineered Barrier Segment Minimum Performance	SE	U
EBDRD 3.7.F(W)	Rock-Induced Waste Package Loading	--	U
EBDRD 3.7.G.1	Emplacement Borehole Wall Temperature	SE	R
EBDRD 3.7.G.2	Vertical Borehole Rock Mass and In-drift Wall Temperatures	SE	R

Controlled Design Assumption
Assumption Status Log
As of Revision 05
EBDRD

Assumption Identifier	Assumption Subject	Responsible Organization (for active assumptions)	Status (New, Revised, Unchanged, Withdrawn)
EBDRD 3.7.G.3	TSw3 Temperature Limit	SE	R
EBDRD 3.7.G.4	Ground Surface Temperature Rise Limit	SE	R
EBDRD 3.7.G.5	Drift Temperature Limit for Borehole Emplacement	SE	U
EBDRD 3.7.G.6	Access Drift Temperature Limit	SE	R
EBDRD 3.7.1.F(W)	Waste Package Information Label	–	U
EBDRD 3.7.1.I	Waste Package Substantially Complete Containment	SE	U
EBDRD 3.7.1.J.1	Waste Package External Dimensions	WP	U
EBDRD 3.7.1.J.2	Waste Package Maximum Mass	WP	U
EBDRD 3.7.1.J.3	Waste Package Surface Finish	WP	U

Controlled Design Assumption
Assumption Status Log
As of Revision 05
EBDRD

Assumption Identifier	Assumption Subject	Responsible Organization (for active assumptions)	Status (New, Revised, Unchanged, Withdrawn)
EBDRD 3.7.1.1.F	Waste Package Drop Tolerance	WP	U
EBDRD 3.7.1.1.G(W)	Postclosure Seismic Loads on Waste Package	--	U
EBDRD 3.7.1.2.A	Waste Package Handling and Transportation Loads	WP	R
EBDRD 3.7.1.2.B	Container Substantially Complete Containment	WP	R
EBDRD 3.7.1.2.C	Controlled Release During Period of Isolation	WP	R
EBDRD 3.7.1.2.D	Container to Limit Liquid Water Contact	SE	U
EBDRD 3.7.1.2.E	Container Information Label	WP	U
EBDRD 3.7.1.2.H.2	Disposal Container Maximum Mass	WP	U
EBDRD 3.7.1.2.H.3	Disposal Container External Dimensions	WP	R
EBDRD 3.7.1.3.A	Criticality Control Requirement	WP	U

Controlled Design Assumption
Assumption Status Log
As of Revision 05
EBDRD

Assumption Identifier	Assumption Subject	Responsible Organization (for active assumptions)	Status (New, Revised, Unchanged, Withdrawn)
EBDRD 3.7.1.3.D	Waste Package Internal Structure Loads	WP	U
EBDRD 3.7.1.4(W)	Waste Container Absorbent Materials	--	U
EBDRD 3.7.2.B	Backfill Permeability	WP	U
EBDRD 3.7.3	Emplacement Hardware Requirements	WP	U

Controlled Design Assumption
Assumption Status Log
As of Revision 05
RDRD

Assumption Identifier	Assumption Subject	Responsible Organization (for active assumptions)	Status (New, Revised, Unchanged, Withdrawn)
RDRD 3.2.1.2.B	Waste Receiving Schedule	SE	R
RDRD 3.2.1.2.C	Preclosure Radiation Exposures and Releases of Radioactive Material	SE	N
RDRD 3.2.1.4.B	Retrievability Period	SE	N
RDRD 3.2.1.6.C	Disposal System Postclosure Performance (40 CFR 191)	SE	R
RDRD 3.2.1.6.D(W)	Physical Barriers	--	W
RDRD 3.2.2.1.E	Annual Dose Equivalent to Member of the Public	SE	N
RDRD 3.2.2.2.A	Dose Limit to Public from Repository Operations	SE	N
RDRD 3.2.2.2.C	Dose Limit to Public in Unrestricted Areas	SE	N
RDRD 3.2.3.1.3.B	Cask Inspection and Decontamination	SE	N
RDRD 3.2.3.1.3.I	Cask Cleaning	SE	N
RDRD 3.2.3.2.2.A.7	Emplacement Concept	SS	R

Controlled Design Assumption
Assumption Status Log
As of Revision 05
RDRD

Assumption Identifier	Assumption Subject	Responsible Organization (for active assumptions)	Status (New, Revised, Unchanged, Withdrawn)
RDRD 3.2.3.2.2.A.11.a	Repository Layout to Limit Waste Package - Water Contact	SE	U
RDRD 3.2.3.2.A.11.b	Layout to Ensure Waste Form Design Limit Temperatures Not Exceeded	SE	N
RDRD 3.2.3.4.B	Non-Potable Water	S	U
RDRD 3.2.3.4.D	Telephone Communications	S	U
RDRD 3.7.1.C	Special Sources of Groundwater	S (Site Investig.)	R
RDRD 3.7.3.5.A.1	General Underground Lighting	SS	R
RDRD 3.7.3.5.A.2	Underground Service Facilities Lighting	SS	R
RDRD 3.7.3.9.E	Site-Generated Hazardous Waste	S	U
RDRD 3.7.4.1.A.2	Storage Capacity for Waste Receipts	S	U
RDRD 3.7.4.1.A.3	Waste Handling Holding Areas	S	U
RDRD 3.7.5.A	Shaft Conveyances	SS	N

Controlled Design Assumption
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RDRD

Assumption Identifier	Assumption Subject	Responsible Organization (for active assumptions)	Status (New, Revised, Unchanged, Withdrawn)
RDRD 3.7.5.A.5(W)	Men-and-Materials Shaft Hoist Limits	–	W
RDRD 3.7.5.B.6	Underground Air Supply	SS	U
RDRD 3.7.5.N.1	Waste Ramp Air Flow	SS	U
RDRD 3.7.5.N.2	Tuff Ramp Air Flow	SS	U
RDRD 3.7.5.N.5	Shaft Size	SS	U
RDRD 3.7.5.O.2	Men-and-Materials Shaft Usage	SS	U

Controlled Design Assumption
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DCS

Assumption Identifier	Assumption Subject	Responsible Organization (for active assumptions)	Status (New, Revised, Unchanged, Withdrawn)
DCS-001	MGDS Operational Center	SE	U
DCS-002(W)	Wet and Dry SNF Handling	–	U
DCS-003(W)	Occupational Exposure Limits	–	W
DCS-004 (W)	ALARA Studies	–	W
DCS-005(W)	One Waste Handling Building	–	U
DCS-006(W)	CMF Requirement	–	U
DCS-007(W)	Waste Treatment Building	–	U
DCS-008	Decontamination Equipment and Space	S	U
DCS-009(W)	Disposal of Low-Level Radioactive Waste	–	U
DCS-010(W)	Hazardous Waste Disposal	–	U
DCS-011	Underground Waste Generation	SS	R
DCS-012	No HLW in Waste Treatment Building	S	U
DCS-013	Waste Generated by Performance Confirmation Activities	S	U
DCS-014(W)	Cask Maintenance Operation	–	U

Controlled Design Assumption
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DCS

Assumption Identifier	Assumption Subject	Responsible Organization (for active assumptions)	Status (New, Revised, Unchanged, Withdrawn)
DCS-015(W)	Transportation Cask Fleet Inventory	–	U
DCS-016(W)	Transportation Cask Fleet Maintenance Frequency	–	U
DCS-017(W)	WHB Dry Handling	–	U
DCS-018(W)	CMF Wet Handling	–	U
DCS-019	Support Facilities Design	S	U
DCS-020	WHB Wet/Dry Handling	S	U
DCS-021	Special Tooling	S	U

Controlled Design Assumption
Assumption Status Log
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DCSS

Assumption Identifier	Assumption Subject	Responsible Organization (for active assumptions)	Status (New, Revised, Unchanged, Withdrawn)
DCSS-001	Drift Orientation	SS	R
DCSS-002(W)	Repository Horizon	--	U
DCSS-003(W)	Underground Excavation Crown	--	U
DCSS-004(W)	Stand-Off Distance	--	U
DCSS-005	Drift Excavation Methods	SS	R
DCSS-006	Maximum Excavation Extraction Ratio	SS	U
DCSS-007(W)	N/A (Never Issued)	--	U
DCSS-008(W)	N/A (Never Issued)	--	U
DCSS-009	Maximum Grade of Drifts	SS	R
DCSS-010	Repository Material Handling Equipment	SS	U
DCSS-011(W)	N/A (Never Issued)	--	U
DCSS-012(W)	N/A (Never Issued)	--	U
DCSS-013(W)	In-Drift Emplacement	--	U
DCSS-014	Shaft Excavation Method	SS	U

Controlled Design Assumption
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DCSS

Assumption Identifier	Assumption Subject	Responsible Organization (for active assumptions)	Status (New, Revised, Unchanged, Withdrawn)
DCSS-015	Ventilated Air Properties	SS	U
DCSS-016	Maximum Underground Air Velocity	SS	U
DCSS-017	Minimum Underground Air Velocity	SS	U
DCSS-018	Minimum Underground Air Volume	SS	U
DCSS-019	Maximum Underground Air Temperatures - Emplacement Drifts	SS	U
DCSS-020	Maximum Underground Air Temperatures - Access Mains	SS	U
DCSS-021(W)	Underground Air Quality	--	U
DCSS-022	"K" Factor for Ventilation Air Flow	SS	U
DCSS-023	Maximum Preclosure Rock Surface Temperature	SS	R
DCSS-024(W)	N/A (Never Issued)	--	U
DCSS-025	Maximum Zeolite Temperature	SE Requirements	R
DCSS-026(W)	Emplacement Drift Backfill	--	U
DCSS-027	Rock Support Materials - Organic Materials Prohibited	SS	U
DCSS-028	Emplacement Drift, Shafts, Ramps Maintenance Plans	SS	U

Controlled Design Assumption
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DCSS

Assumption Identifier	Assumption Subject	Responsible Organization (for active assumptions)	Status (New, Revised, Unchanged, Withdrawn)
DCSS-029	Maximum Underground Air Temperatures - Exhaust Mains	SS	U
DCSS-030	Limit Ground Surface Uplift	SE	U
DCSS-031	Limit Temperatures in PTn	SE	U
DCSS-032	Temporary Surface Facilities for Underground Construction	S, SS	U
DCSS-033	Emplacement Drift Standoff	SS	U
DCSS-034(W)	Emplacement Drift Ground Support	–	W
DCSS-035(W)	Emplacement and Development Area Ventilation	–	W
DCSS-036	Emplacement Drift Entrance Doors	SS	U
DCSS-037	Invert Material	SS	R
DCSS-038	Air Monitoring Underground	SS	U
DCSS-039	Ventilation System Pressure Differential	SS	U
DCSS-040	Diesel Equipment Limitation	SS	N
DCSS-041	Subsurface Configuration for Water Drainage	SS	N

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DCWP

Assumption Identifier	Assumption Subject	Responsible Organization (for active assumptions)	Status (New, Revised, Unchanged, Withdrawn)
DCWP-001	Limit Fuel Cladding Temperature	SE	R
DCWP-002	Limit HLW Glass Temperature	SE	U
DCWP-003(W)	Alternate Waste Package Disposal Container Materials	--	U
DCWP-004(W)	Waste Package Materials	--	W
DCWP-005(W)	Tentative Co-Disposed DOE SNF WP Dimensions	--	U
DCWP-006(W)	Tentative WP External Dimensions for Canistered SNF	--	U

Controlled Design Assumption
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TDS

Assumption Identifier	Assumption Subject	Responsible Organization (for active assumptions)	Status (New, Revised, Unchanged, Withdrawn)
TDS-001 (W)	Fault Displacement, Locations, Attitudes	--	U
TDS-002	Topography/Morphology	NEPO	R
TDS-003	Soil Properties	NEPO	R
TDS-004	Meteorology	R/EFP	R
TDS-005(W)	Seismic Environment	--	U
TDS-006	Design Basis Tornadoes	R/EFP	R
TDS-007	Winds (Operating Basis and Standard)	R/EFP	R
TDS-008	Floods (Design Basis)	NEPO	R
TDS-009(W)	Surface Facilities/ALARA - Reclassified as DCS 002	--	U
TDS-010(W)	ALARA Studies - Reclassified as DCS 004	--	U
TDS-011(W)	Waste Handling Building - Reclassified as DCS 005	--	U
TDS-012(W)	Transportation Cask Maintenance Facility - Reclassified as DCS 006	--	U
TDS-013(W)	Waste Treatment Building - Reclassified as DCS 007	--	U

Controlled Design Assumption
Assumption Status Log
As of Revision 05
TDS

Assumption Identifier	Assumption Subject	Responsible Organization (for active assumptions)	Status (New, Revised, Unchanged, Withdrawn)
TDS-014(W)	Decontamination	--	U
TDS-015(W)	Rod Consolidation	--	U
TDS-016	Outdoor Air Temperature/Humidity	R/EFP	N

Controlled Design Assumption
Assumption Status Log
As of Revision 05
TDSS

Assumption Identifier	Assumption Subject	Responsible Organization (for active assumptions)	Status (New, Revised, Unchanged, Withdrawn)
TDSS-001	In Situ Stress	NEPO	R
TDSS-002	Ground Surface Temperature, Rock Thermal Gradient	NEPO	R
TDSS-003	TSw2 In Situ Saturation	NEPO	R
TDSS-004	TSw2 Rock Densities	NEPO	R
TDSS-005	TSw2 Thermal Conductivity	NEPO	R
TDSS-006	TSw2 Heat Capacitance	NEPO	R
TDSS-007	TSw2 Thermal Expansion	NEPO	R
TDSS-008	TSw2 Elastic Modulus	NEPO	R
TDSS-009	TSw2 Poisson's Ratio	NEPO	R
TDSS-010	TSw2 Uniaxial Compressive Strength	NEPO	R
TDSS-011	TSw2 Mohr-Coulomb Strength Parameters	NEPO	R
TDSS-012	TSw2 Porosity	NEPO	R
TDSS-013(W)	Deformation Modulus	–	U
TDSS-014(W)	Rock Compressive Strength	–	U

Controlled Design Assumption
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TDSS

Assumption Identifier	Assumption Subject	Responsible Organization (for active assumptions)	Status (New, Revised, Unchanged, Withdrawn)
TDSS-015(W)	Rock Tensile Strength	--	U
TDSS-016(W)	N/A (Never Issued)	--	U
TDSS-017	Rock Joint Orientation and Frequency	NEPO	R
TDSS-018(W)	TSw2 Rock Joint Strength	--	U
TDSS-019(W)	Rock Joint Stiffness	--	U
TDSS-020(W)	Rock Mass Quality Indices	--	U
TDSS-021	Surface Air Temperature/Humidity	R/EFP	R
TDSS-022	Wind Intensity	R/EFP	R
TDSS-023(W)	Unsaturated Zone Ground Water Flux	--	U
TDSS-024(W)	Unsaturated Zone Ground Water pH	--	U
TDSS-025	Unsaturated Zone Ground Water Chemistry	NEPO	R
TDSS-026	Bounding Water Influx	NEPO	R

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REQSE

Assumption Identifier	Assumption Subject	Responsible Organization (for active assumptions)	Status (New, Revised, Unchanged, Withdrawn)
REQSE-001(W)	--	--	U
REQSE-002(W)	--	--	U
REQSE-003(W)	--	--	U

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Key 025(W) B-13
Key 026(W) B-14
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