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LPDR
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Wm-11 (2)
Wm-16 (2)

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COMPARISON OF THE PLANNED IN SITU TESTS
IN THE EXPLORATORY SHAFT FACILITIES

DRAFT VERSION 3.0 1/27/87

BASIC GEOLOGIC CHARACTERIZATION TESTS	NNWSI	BWIP	SRPO	OBJECTIVE/RATIONALE NNWSI	BWIP	SRPO
teral exploratory coring from hin exploratory shaft	(x)	(x)	(x)	Lateral boreholes will be drilled from within the shaft as part of the radial borehole tests (13 levels) and the shaft convergence tests, (3 levels).	Boreholes will be drilled in ES-1 through portholes in the shaft casing to provide data on the shaft seal, the disturbed rock zone, groundwater inflow, rock quality, and shaft station stability. The boreholes will be oriented horizontally and at 20 degrees below horizontal.	Several cored boreholes will be drilled within the ESF shaft at selected horizons as par of the sampling, testing, and instrumentation plan. The core holes will be less than 100 ft.
Drift-wall mapping and photography	(x)	(x)	(x)	Mapping of the drift wall will document the lateral variability and lithologic continuity along approximately 100-m exposures in several directions from the shaft. The extent and nature of the fractures is of interest and the information will be used to help predict the ability of the host rock to isolate and contain nuclear waste and toward predicting the retrievability of that waste. The data will be combined with fracture-mapping from the shaft to determine the three-dimensional fracture network. Infilling minerals will also be collect for isotopic dating for estimating tectonic rates.	A major portion of the mapping will be done concurrent with construction of the facility. The mapping will concentrate on geologic features that might be obscured by the support systems and those features that might effect stability and/or groundwater inflows. The recorded data will include a discription of the rock including type, orientation, alteration, and spacing of joints, the intraflow structures, groundwater inflow rate, origin and location, tectonic features, and construction observations. Rock samples will also be collected.	The mapping activity is designed to assess and record the lithologic characteristics, structural discontinuities, and the presence of brine or water pockets. The data will also be used to confirm the geologic conditions inferred from surface investigations and to select representative locations for in situ tests. The data will also be used to look for evidence of tectonic activity and to determine the extent of man made disturbance.
Lateral coring from drifts	(x)	(x)	(x)	The lateral cores are planned to explore the geology within the waste-emplacement level beyond the drifts. The structural and lithologic continuity within and outside of the block will be studied as well as the nature and conditions of faults, fractures, and lithophysal cavities. These	Lateral cored boreholes will be drilled to provide geologic, hydrologic, and geophysical data on the area surrounding the ESF. The boreholes will extend 1000 feet beyond the ESF.	The drilling and associated core sampling and logging allows for direct observation and testing of the rock in areas that will not be reached by the exploratory drifts. The coreholes provide information on subsurface lithology and structure, provide core samples for testing, and allow for aqueous and gaseous sample collection. The coreholes will be 100 ft. in length or less.

BWIP 2503
NNWSI 1398
SALT 1605

				data will add to the ability to extrapolate the results of in situ tests within the exploratory shaft to the rest of the repository.		
Borehole Condition/Convergence Monitoring	(x)	(x)	(x)	Shaft, drift, and borehole convergence will be monitored in selected instrumentation holes, and demonstration "tests" of the large diameter (36 in.) horizontal boring machine. Hole stability, convergence, and related rock mechanics and engineering parameters will be monitored as elements of the boring test.	A prototype canister hole will be drilled to provide information regarding the stability of canister holes under ambient conditions. This assessment will affect waste package design and emplacement functions and should provide preliminary information on the need for a canister hole liner prior to waste emplacement.	Direct inspection of boreholes will be performed to detect the presence of any mechanical conditions, such as spalling, separation or offset of discontinuities, solution/deposition. etc., that are not necessarily predictable by numerical or other types of analyses. Borehole convergence monitoring will be used to observe the time-dependent behavior of the rock mass, especially at the interface of discontinuities.
Overcore stress tests	(x)	(x)	(x)	The objective of the overcore tests is to determine the complete in situ state of stress above, within, and below the repository host rock in that portion of the unsaturated zone penetrated by the ESF. Knowledge of the in situ stress is necessary to optimize the design of the repository and to evaluate the stability of excavations and engineering structures. The stress information is also needed for input and boundary conditions for geomechanical models used in repository performance assessment.	Preliminary estimates of the principle horizontal stresses within the preferred candidate horizon using hydraulic fracturing indicate high horizontal stresses. Considering the implication of stress for stability and constructibility of openings, the need for in situ stress data will be given a high priority ranking among ES geomechanics needs. Overcoring will be the principal method of obtaining in situ stress data. Stress data is also needed for numerical and empirical models.	These tests will be used to measure the absolute stress of elastic strata. They will be conducte in the shaft and possibly in vertical boreholes from the ESF. The technique is not suitable for stress measurement in the salt strata which exhibits a complex inelastic time and temperatur dependent behavior.
Demonstration breakout room test	(x)	(x)	(x)	Monitoring the behavior of underground excavations is the most reliable aid in understanding the behavior of a rock mass for advanced design and construction evaluations. The DRR tests will be used to evaluate the rock-mass responses to effects of mining for purposes of defining bounds of the material response so designed-oriented information can be used for extrapolation throughout the block. The rooms will also be used for other in situ tests.	The breakout will present excavation conditions for which there is no known precedent in columnar basalt due to the magnitude of the in situ stresses. Geomechanics data will be collected to determine whether openings can be excavated in an acceptable manner.	A Facility Mechanical Response Test will be performed to monitor the safety and stability of the opening, to measure stress-deformation /time behavior of opening for validating models, and to validate or refine the design of the support, opening shape, layout, etc. The effects of variations in geologic conditions on stress and deformation of excavations will be assessed and critical aspects of geology, constability and opening and support behavior will be identified. The data will help to assess the ability of the site to isolate radioactive waste.
Sequential drift-mining test	(x)	(x)	(x)	The SDM test will be used to (1) validate a geomechanical model to establish predicitive capabilities for	A room-scale enlargement/mine-by test will be conducted to monitor rock displacements, stress changes, and hydraulic conductivity change	Data from this test will be used to validate geomechanical models used to predict the rock mass response under

				design activities; (2) define limits for the relaxed zone using exploratory boreholes and mechanical measurements; (3) improve mining evaluations; and (4) relate air and water permeability measurements to each other for reference in hydrological calculations.	around the alignment of a repository-scale opening as it is extended and enlarged to prototype dimensions. The test results will be used to optimize excavation techniques and support requirements and to minimize the disturbed rock zone. The monitored behavior of the opening will also be used for comparison with numerical modeling results to build confidence in the codes and modeling methods being used for design.	ambient temperature conditions. The data will also provide a basis for addressing questions related to the structural stability, safety during construction, waste emplacement, and retrieval. Finally, the test provides data to predict the short-, intermediate-, and long-term mechanical environment surrounding the waste canisters.
...ss hole seismic test	(x)	(x)	(x)	Vertical seismic profiling is planned within the ESF and will provide calibration data for gross rock characteristics and fracture variability through the penetrated interval adjacent to the openings. Comparison between this data and calibration data collected at other locations across the Yucca Mountain block will provide the means to confidently extrapolate structural and stratigraphic conditions between surface drilled boreholes.	This test is considered to be a potentially optimum method for investigating the spatial variation of rock mass deformability. The test will be used to determine the extent of the disturbed rock zone and excavation-induced stress distribution. The results will be compared with other tests to verify the test method.	The cross hole seismic test is planned to investigate the extent of the disturbed zone, for rock mass characteristics, and the characteristics of the backfill or seal materials.
Seismic Surveys	(x)	(x)	(x)	Seismic refraction and reflection studies will be performed in conjunction with other geologic studies.	Cross-hole seismic surveys will be done to characterize the test site and damaged rock zone. Seismic refraction and reflection studies will also be performed in conjunction with other geologic studies.	Seismic surveys provide basic geological and geomechanical site information such as boundaries between stratigraphic units, structural features, and the mechanical condition of the repository rock mass.
Caliper log	(x)	(x)	(x)	Caliper logs will be made to evaluate the formation damage and monitor changes in the borehole diameter.	Calipers will be used to determine the location of borehole breakouts and changes in the borehole diameter.	Caliper logs will be made to evaluate the formation damage and monitor changes in the borehole diameter. This information will also be used to estimate the deformation modulus of the rock.
Gamma-gamma density log	(x)	(x)	(x)	These tests measure the apparent bulk density of the rock and are used to to identify differences in the lithology, stratigraphy, and mineralogy.	Tests will be used to record the apparent bulk density of formations by monitoring gamma rays backscattered from the formation.	These tests measure the apparent bulk density of the rock and are used to to identify differences in the lithology, stratigraphy, and mineralogy.
Sonic log	(x)	(x)	(x)	The sonic (acoustic) tests will be used to detect changes in the lithology and stratigraphy, the porosity and dynamic modulus.	The acoustic wave train propagated by an acoustic source is used to determine the bulk porosity.	The sonic (acoustic) tests will be used to detect changes in the lithology and stratigraphy, the porosity and dynamic modulus, the location of fractured zones, and the presence of gas.

Neutron-epithermal neutron log	(x)	(x)	(x)	The tool is used to determine the moisture content and bulk porosity of the rock surrounding the borehole.	The tool is used to determine the moisture content and bulk porosity of the rock surrounding the borehole.	This information will be used to estimate changes in lithology, stratigraphy, and mineralogy, porosity and water content, and the presence of fractures.
Fluid temperature log	(x)	(x)	(x)	This test will detect the presence of perched water zones if they are intersected by a borehole.	These tests are used to determine the source and direction of circulation of groundwater inflow into a borehole.	The fluid temperature log data will be used to identify possible water movement and for estimating the temperature gradient with depth.
Electric survey	(x)	(x)	(x)	The electrical survey will be used to identify anomalies.	Single point resistivity logs will be used to determine the discontinuity characteristics.	The electrical survey will be used to identify anomalies such as brine pockets, conductive zones, fault and fracture zones, and breccia pipe in the rock mass surrounding the borehole.
Seismic Monitoring	(x)	(x)	(x)	Seismic monitoring in the ESF is being discussed but it is not yet certain that it will be needed. Therefore, this type of monitoring is not planned at this time. A surface seismic monitoring system is already in place.	The seismic monitoring study will be used to monitor the dynamic response of the various geologic units and calculate the interaction between these units. The monitors will also be used as part of the mine safety program.	The seismic monitoring study provides input to the seismic design of the repository and information on potential seismic hazards during the life of the repository.
Shaft convergence test	(x)	( )	(x)	The convergence test will be used to determine the horizontal stresses on the shaft for preliminary site characterization, to measure the convergence of the rock mass into the excavated cavity to evaluate relaxation phenomena as they apply to materials characterizations and shaft designs, and to monitor the loading of the shaft liner for purposes of confirming design assumptions.	Constructing the shaft by blind boring prevents conducting convergence measurements during construction. The need for post-construction monitoring is being evaluated at this time but none is planned at this time.	Shaft convergence will be monitored for safety and to assess the stability of the opening. The stress-deformation/time behavior of the opening will be monitored to validate models and validate or refine the design of the support, opening shape, layout, etc. The effects of variations in geologic conditions on stress and deformation of excavations will be assessed and critical aspects of geology, constructability and opening and support behavior will be identified. The data will help to assess the ability of the site to isolate radioactive waste.
Hydraulic fracturing stress test	( )	(x)	(x)	The fractured nature of the welded tuff at the NNWSI site makes it difficult to design a hydraulic fracturing test that will give meaningful (high confidence) data.	Hydraulic fracturing tests will be performed to confirm earlier surface test results and for comparison with overcoring test results. The hydraulic fracturing method also will be used to run tests in the exploratory boreholes at large distances from the shaft to extend the characteri-	The hydraulic fracturing tests will be used to assess the virgin state of stress and the stress changes that result from excavation of the ESF and heat loads applied during certain tests. The state of stress is a fundamental boundary condition in evaluating geomechanical

					zation to the scale of the repository block.	response to various loads. Monitoring changes in stress will be used to characterize the system response for model validation and for design evaluation.
Plate-loading test	(x)	(x)	( )	Information from the plate loading test will be used to assemble a statistical data base of deformation modulus measurements. This data base will be used for performance assessment sensitivity analyses, to define the upper- and lower-bounds for the high- and low-lithophysal content tuffs, and to extrapolate values for the modulus throughout Yucca Mountain.	The test will be performed to determine the large-scale deformation modulus and possibly the creep parameters of the rock mass. It will also be used as a method for quantifying the effects of anisotropy and fracturing on the deformation properties of the rock mass.	The plate loading/jacking test is not considered appropriate for use in salt strata due to the large uncertainties associated with interpreting the data from a test and the high cost to conduct the test. The complex rheological properties of the salt strata make it difficult to relate the load/deformation data to the rock mass properties.
Borehole jacking test	( )	(x)	(x)	The modulus of deformation will be obtained from the plate loading test. Additional comparative data may also be derived from other geomechanical tests such as the slot strength and demonstration breakout room tests.	The test method provides a means of rapidly estimating the variability of deformation modulus of a rock mass at numerous locations.	The borehole jacking tests will be used to measure the in situ modulus of deformation in elastic strata for thermomechanical modeling, and as an index test.
Slot-strength/Flat jack tests	(x)	(x)	( )	Objective is to determine the field-scale compressive bearing strengths and relate these to laboratory measurements for use in repository design functions. The tests provide an estimate of the stress in the tunnel wall perpendicular to the direction of the slot. The test will be performed at the upper and lower DBR's to assess variations between the two zones.	Small flat jack tests will be used to examine in situ stresses close to the surface of the opening in the zone where stress relief overcoring is not expected to produce useful information. Large flat jack tests will be used to determine the in situ rock mass deformability for comparison with the plate bearing and small-scale test results. The test is considered attractive due to the simplicity of performing the test (conceptually) and to enhance interpretation of other test data.	The complex stresses around the excavation and the rheological properties of salt result in large uncertainties, and hence this test is not planned for salt strata.
Shaft wall mapping, photography and specimen sampling	(x)	( )	(x)	The data collected will be used to study the vertical continuity of fractures at depth and describe the geologic medium in which the repository will operate. This will provide a framework for evaluating the hydrologic, geochemical, and geomechanical test results in order to address the concerns of isolation, containment, and retrievability as they apply to the regulations and siting guidelines.	The selected method of construction of the Exploratory Shaft, blind boring with drill and as temporary wall support, precludes the opportunity for mapping and collecting samples from the shaft wall.	The test measures the in situ shear strength of discontinuities in rock mass (joints, faults, bedding planes) and will be used to evaluate scale effects.

				In addition, the mineralogy of faults and fractures and the alteration and mineralogy of the various rock types is also planned. Vertical seismic profiling to detect and characterize fractures near the shaft wall will be conducted.		
Vertical exploratory coring shaft locations	( )	( )	(x)	No borehole is planned within the circumference of the exploratory shaft. However, an exploratory shaft design borehole has been drilled 640 feet from the exploratory shaft location. The need to readdress the need for vertical coreholes will only be necessary if unanticipated conditions are encountered during shaft sinking or if the location of the exploratory shafts change significantly.	No borehole is planned within the circumference of the exploratory shaft. However, an exploratory shaft design borehole has been drilled 300 feet east of the exploratory shaft location. The information from this borehole is considered to be representative of the rock mass at the exploratory shaft locations.	SRP will be drilling two exploratory shaft design boreholes. The core will allow some determination of the conditions to be encountered during shaft construction. This information when compared with the actual conditions, establishes the validity of predictive models based on the borehole data.
Underground gravity survey	( )	( )	(x)	The NNWSI site has had airborne gravity and magnetic surveys made already. Based on that data there appears to be no compelling reason to run gravity surveys in the ESF.	There are no plans to run gravity surveys because of the complexity of the data analysis.	The gravity survey will be used to estimate the location of possible brine inclusions and fracture zones based on variations in density.
Room backfill test	( )	( )	(x)	This test is not planned at this time. If backfilling of the repository drifts is required, backfilling material design and testing will be done as part of the performance confirmation testing.	Room backfill testing will be done at the Near-Surface Test Facility. The test does not need to be done in situ during site characterization. Therefore, the in situ test are not planned until the performance confirmation phase of the testing program.	The objective of this test is to demonstrate the interactions between crushed salt backfill in a repository environment, to provide field data which can be used to assess the long-term behavior of the backfill material, and to validate predictive thermomechanical models.
Demonstrate boring technology (horizontal)	(x)	( )	( )	The main purpose is to demonstrate the ability of the DPBM (boring machine) to bore long horizontal waste-canister emplacement holes under actual subsurface conditions.	Production drilling equipment will not be available during site characterization testing in the ESF. However, a full-scale canister hole will be constructed as part of the heater test that will provide information concerning the ability to create an emplacement hole in jointed basalt and its stability in a canister environment (high-temperature).	No demonstration of horizontal or vertical boring technology is planned during site characterization.

HYDROLOGIC CHARACTERIZATION TESTS :						
ix property test	(x)	(x)	(x)	This test is intended to determine quantitatively the magnitudes and associated statistical variations of the rock-matrix hydrologic properties appropriate to the vertical sequence of tuffs penetrated by ES-1. Bulk samples will be collected during the excavation of ES-1. Specific tests include moisture content, matrix potential, permeability, density, and porosity. The functional relations between moisture content, permeability, and matrix potential will also be determined.	Borehole cluster tests will be used to stress a large volume of rock to reduce the uncertainty in measuring the hydrologic properties of the flow interior. Properties include large-scale hydraulic conductivity and storativity under variable test volumes. A chamber test is also planned to quantify the groundwater flow into a large underground opening within the interior of a basalt flow and the large-scale hydraulic conductivity and storativity of the interior. The test will also provide a correlation between single, cluster scale, and large-scale tests.	There are no plans for a specific matrix property test, but matrix properties will be obtained from single borehole hydraulic conductivity, cross hole hydraulic conductivity, borehole seal and room seal tests.
Intact-fracture test	(x)	(x)	(x)	The objective of this test is to evaluate the fluid flow and chemical transport properties of single, relatively undisturbed fractures under a range of stress conditions. The data will be used to calibrate, test, and validate numerical and analytical models of fracture flow and as a basis for estimating the hydrological properties of various tuffs.	Crosshole borehole tests will be performed within the cluster test boreholes to determine the hydraulic properties of rock zones of interest.	Cross-hole hydraulic conductivity tests will be conducted to estimate the large-scale hydraulic conductivity and specific storage for materials within a through-going rock discontinuity or permeable interbed. The test also provides information on hydraulic conductivity and lateral extent of the discontinuity, as well as the presence of hydrologic boundaries. The tests provide bulk parameter values suitable for performance modeling at the room and possibly the repository scale.
Infiltration test	(x)	(x)	(x)	The purpose of this test is to measure and determine relationships among rock-mass hydraulic and transport properties of the Topopah Spring welded unit, specifically the hydrologic conditions under which fracture and matrix flow occurs.	Infiltration or inflow rates will be monitored in the borehole tests and chamber room test. The chamber room test will use one or several methods depending on the inflow rates. Test methods include constant flow rate injection, constant flow rate withdrawal, and constant head withdrawal.	Borehole seal tests will be used to evaluate the short-term aspects of borehole seal design/emplacement for holes drilled in the repository horizon. Room seal tests will be performed to evaluate the room seal design and construction and the short-term aspects of seal performance. Data for validating hydrological models will also be obtained.

Bulk-permeability test	(x)	(x)	(x)	The purpose of this test is to determine the validity of the continuum hypothesis for fluid flow in the fractured Topopah Spring welded tuff unit and to estimate the minimum volumetric dimensions of the rock that represents such a continuum. The test will also be used to develop the capability to estimate hydrologic properties using fracture properties and limited hydrologic test data and to evaluate the effects excavation has on the hydrologic properties of the rock.	Borehole cluster tests will be used to stress a large volume of rock to reduce the uncertainty in measuring the hydrologic conductivity or permeability of the rock. A chamber test is also planned to quantify the groundwater flow into a large underground opening within the interior of a basalt flow and the large-scale hydraulic conductivity.	The room scale test (discussed above) will indirectly provide bulk permeability data time over a large surface area.
Radial-borehole test	(x)	(x)	(x)	The objectives of this test are to detect vertical movement of water in the unsaturated zone, evaluate the potential for lateral movement of water along the hydrologic contacts, and evaluate the affect excavation has on the hydrologic properties of the rock surrounding the shaft. The test will also provide data on the tortuousity, effective porosity, and the unsaturated zone.	These tests will be used to provide data from which the hydraulic properties of the disturbed and undisturbed rock mass can be evaluated. The physical properties of interest include hydraulic conductivity and storativity. Fluid pressures in the basalt at the proposed repository level will also be monitored using boreholes equipped with packers and pressure transducers. This data will also be used to estimate the directional hydrologic properties of the surrounding rock.	Borehole hydraulic conductivity tests are planned to construct hydraulic conductivity profiles and to obtain probable ranges in conductivity values for intact rock.
cavation effect test	(x)	(x)	(x)	Excavation in fractured rock may alter the hydrologic properties in the vicinity of the opening. These tests will estimate what the effects of excavating and lining the shaft are on the magnitude and extent of the modification of hydrologic properties of the Topopah Spring welded unit.	A chamber test is planned to quantify the expected groundwater flow into a large underground opening within the interior of a basalt flow and the large-scale hydraulic conductivity and storativity of the interior.	The Facility Hydrologic Response Monitoring test will be used to establish and/or confirm the boundary conditions for the site geohydrological model, to measure the large-scale hydrologic parameters of the repository and overburden media, and to assess the hydraulic perturbations and the ability of the site to isolate waste.
Hydrochemistry test	(x)	(x)	(x)	Purpose is to determine the chemical composition and physical properties of water occurring in pores, fractures, and perched zones within the unsaturated zone. Results will be used to estimate 1) resistance time of water, 2) evaluate types and magnitudes of of chemical reactions operative in the	Groundwater samples will be obtained from ES testing facilities in order to assess the oxidation-reduction conditions and the chemical and particulate constituents of the groundwater.	The objective of these tests is to obtain representative chemical and physical data of the fluids in the repository environment.

				unsaturated zone, and 3) evaluate sources of recharge, timing, and climatic conditions of recharge, and precipitation sources.		
Tracer test	(x)	(x)	(x)	Purpose is to determine the rate of water movement downward through the unsaturated zone to the water table beneath Yucca Mountain. A diffusion test is also planned to determine the extent nonsorbing tracers diffuse into water filled pores of two of the tuffs the ES-1 will penetrate. The tests will provide an estimate of the diffusivity coefficients for each of the tuffs in which the tests were performed.	Tracer tests are planned in boreholes in the cluster test and in shaft boreholes. The objectives of the tests are to quantify the effective porosity, dispersivity, and solute retardation of a large volume of rock within the flow interior (cluster test) and flow tops (shaft boreholes).	Cross-hole tests will be used to obtain large-scale measurements of hydraulic conductivity and specific storage for materials within a through-going discontinuity or permeable interbed. The test wil also provide information on the applicability of the equivalent porous media approach to hydrologic characterization of discontinuous salt. Finally, the test provide bulk values of effective porosity for performance modeling at room-scale and scale. Define connectivity of intact rock pore space and how it relates to diffusive transport of solute through connected pores.
Hydraulic conductivity of shaft seal interval	( )	(x)	(x)	The NWWSI Project is not yet committed to the need for exotic shaft liner seals at this time due to the fractured and unsaturated nature of the host rock. However, this question continues to be evaluated and depending on the outcome, additional sealing tests may be proposed as part of performance confirmation testing.	The groundwater inflow will be measured in radial boreholes around the shaft at incremental distances from the shaft liner to measure the apparent permeability of the cement grout and the success of the shaft liner system. Core samples of the grout will be tested for their strength. Other tests include ultrasonic geophysical probing to determine the bulk density and bonding characteristics of the cement and steel/cement/rock interfaces, and constant injection tests to determine the hydraulic conductivity of the components and interfaces.	This test will be performed at selected shaft locations.
Room seal test	( )	(x)	(x)	The NWWSI Project perceives no need to conduct a room seal test due to the emplacement method design and also due to the expected high-permeability of the fractured tuff. The bulk permeability test, as presently conceived, does require that a bulkhead seal be installed in order to pressurize and evacuate the test room. Construction of a bulkhead in fractured tuff will be demonstrated in a proposed prototype test in G-tunnel.	Design and installation tests only will be performed during site characterization. The performance of the room seal will be tested during the performance confirmation phase.	The room seal test will evaluate the design of the room seals and their construction and the short-term aspects of seal performance. The test will also serve as a validation test for hydrologic models.
Borehole seal test	( )	(x)	(x)	The NWWSI repository design concepts do not	Design and installation tests only will be	The borehole seal tests are intended to

				require borehole seals.	performed during site characterization. The performance of the borehole seal will be tested during the performance confirmation phase.	investigate the short-term aspects of borehole seal design and construction for the boreholes drilled in the repository horizon.
Brine migration test	( )	( )	(x)	This test is not relevant to unsaturated tuff.	This test is irrelevant because brine does not exist naturally in the Hanford basalts.	The objective of the brine migration test is to evaluate the migration of brine in the vicinity of the waste canister replacement hole and validate associated predictive models used for performance assessment.
Perched-water test	(x)	( )	( )	The purpose of the test is to evaluate the hydrogeology of the Calico Hills nonwelded unit to determine: 1) whether water moves through the Calico Hills by matrix or fracture-flow, 2) whether structural flow paths are interrupted at the Topopah Spring welded/Calico Hills nonwelded unit contact, 3) the potential for retardation of radionuclides migrating along fractures by sorption and diffusion into the matrix, and 4) the potential for formation of perched water above or within this unit. Knowledge of hydrologic properties of and flux through the matrix, fractures, and rock mass of this unit should permit determination of realistic and defensible hypotheses for mechanisms of flow, flow paths, and travel times.	The BWIP candidate repository horizon lies within a saturated medium and, therefore, such a test is irrelevant.	This test is applicable to non-saturated strata and is not applicable to the saturated strata at the Deaf Smith County site.
NEAR-FIELD & THERMALLY PERTURBED						
Waste package environment test	(x)	(x)	(x)	The primary purpose is to provide information about the near-field hydrological, thermal, and mechanical environment of the waste package for use in assessing the expected performance of the waste-package subsystem.	The objective of the heater test is to obtain direct observational evidence of canister hole stability under elevated temperature conditions and provide data for correlating laboratory scale and rock-mass scale thermal conductivity and thermal expansion coefficients.	The objective of this test is to evaluate the thermomechanical response of the rock salt in the near-field (canister scale) and the interactions between the salt and the canister. The test data will also be used to validate the predictive thermomechanical models and provide canister corrosion data.
Canister-scale heater test	(x)	(x)	(x)	Emphasis of the test is documenting	The objective of the heater test is to obtain	The objective of this test is to evaluate

				the behavior of the rock around the opening that envelops the waste-package system. Temperature changes and volumetric deformation responses to heat fluxes on the canister scale will be used to validate models, the retrievability aspects at high temperature will be evaluated, and radon, radon-daughter concentration build-up as a function of heat load will be monitored.	direct observational evidence of canister hole stability under elevated temperature conditions and provide data for correlating laboratory scale and rock-mass scale thermal conductivity and thermal expansion coefficients.	the thermomechanical response of the rock salt in the near-field (canister scale) and the interactions between the salt and the canister. The test data will also be used to validate the predictive thermomechanical models and provide canister corrosion data.
Small-scale heater test	(x)	(x)	(x)	Objectives are to 1) evaluate the thermal behavior of welded tuff with high lithophysal-void contents, 2) monitor the possible migration patterns around the heater, and 3) evaluate the thermomechanical expansion in a direction parallel to the heater to verify laboratory-field scaling assumptions.	Thermal conductivity probes will be used to obtain a large number of in situ thermal conductivity measurements. This information will be used as input into heat transfer analyses to predict the temperature distribution within the repository with time.	Thermal conductivity probes will be used to to obtain a large number of in situ thermal conductivity measurements for predicting temperature distributions around the repository.
Heated block test	(x)	(x)	( )	Objectives of the experiment are to 1) validate three-dimensional deformational and temperature models, 2) measure fracture permeabilities and determine their dependencies on stress and temperature, 3) monitor changes in the block moisture content distribution as a function of temperature and position for PA data, and 4) evaluate the cross-borehole measurement potential for monitoring changes in the blocks mechanical and hydrological state.	A heated block test is planned to determine the effect of temperature on host rock deformability and for the study of thermal and thermomechanical properties of the host rock. It affords the opportunity to test at the rock mass-scale with a significant degree of of control over boundary conditions.	This intermediate-scale test for investigating coupled thermomechanical properties is not plann for the salt project. The relative continuous nature of salt is expected to produce representative properties from laboratory testin of blocks. The results will be scaled up to the larger scale waste package heater, room heat and room backfill tests without any major intermediate-scale testing. Some intermediate-scale results will be obtained from the pla thermal conductivity probe testing.
Room-scale heater test	( )	( )	(x)	The need for a full-scale heater test will be based on the results of the smaller-scale heater tests in the ESF and the subsequent modelling of the thermal response. If a need is indicated, a full-scale heater test will be performed during the performance confirmation phase of testing.	A room-scale heater test is proposed as an alternative test in the DWIP test program. The timing of the production of license application will not permit conduct of such a test during site characterization. The use of the test will be invoked should insufficient confidence in the model validation studies result from performance of the suite site characterization tests.	The objective of the room-scale heater test is to evaluate the thermomechanical response of a full-size repository room and evaluate the room stability effects. The test data will also be used to validate predictive thermomechanical models used for design and performance assessment.