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Nuclear Waste Policy Act
(Section 113)

Site Characterization Plan

Yucca Mountain Site, Nevada Research and Development Area, Nevada

Volume IV, Part B

Chapter 8, Section 8.2, Issues

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8.2 ISSUES TO BE RESOLVED AND INFORMATION REQUIRED DURING SITE CHARACTERIZATION

As described in Section 8.1, the concept of the issues hierarchy is one of the two themes underlying the site characterization program that has been developed for the Yucca Mountain site. The key issues, making up the highest tier in the hierarchy, are the key issues identified in the Mission Plan (DOE, 1985b). Statements of these issues, which are derived from the four system guidelines of the DOE general siting guidelines (10 CFR Part 960), are provided in Table 8.2-1. Key Issue 1 addresses the requirements related to containment and isolation; Key Issue 2 covers protection of the general public and workers from radiological exposures; Key Issue 3 addresses the protection of the quality of the environment; and Key Issue 4 covers the DOE concerns that the mined geologic disposal system is cost effective and can be constructed, operated, closed and decommissioned on the basis of reasonably available technology. The key issues address the primary NRC postclosure requirements for containment and isolation, and the preclosure radiological safety requirements.

8.2.1 ISSUES TO BE RESOLVED

The issues within each key issue in the Office of Geologic Repositories (OGR) Issues Hierarchy (DOE, 1986d) represent the current DOE understanding of the questions that should be answered in order for the key issue to be resolved. Issues are often correlated with the principal NRC requirements addressing a specific repository design or site feature, and thus final resolution of an issue may be confirmed only at the time of licensing. As described in Section 8.1.2, issue resolution strategies have been developed for each issue in the issues hierarchy. From these strategies, preliminary site-specific data needs have been derived and a site characterization program has been designed to obtain sufficient data to satisfy the information requirements. The issues in Key Issue 3 are not included in the SCP, because the definition of site characterization in the Nuclear Waste Policy Act (NWPA) excludes socioeconomic, transportation, and environmental studies. Details of the information requirements for environment-related topics will be presented in other DOE documents.

Table 8.2-2 lists all performance and design issues associated with Key Issues 1, 2, and 4, arranged by issue. Site-specific information needs, relevant to resolution of each issue, are also presented in Table 8.2-2. Identification of these information needs is described later in this section.

Figures 8.2-1, 8.2-2, and 8.2-3 display the relationships between the regulatory requirements of 10 CFR Part 60, 10 CFR Part 20, 40 CFR 191, Subpart A, and 10 CFR Part 960 and the performance and design issues. These relationships are explained more fully in DOE (1986d).

In parallel with the development of issue resolution strategies for each of the issues, the physical elements of the repository system were defined.

Table 8.2-1. Statements of the key issues in the Office of Geologic Repositories issues hierarchy

Issue	Statement of key issue
Key Issue 1	Will the mined geologic disposal system at Yucca Mountain isolate the radioactive waste from the accessible environment after closure in accordance with the requirements set forth in 40 CFR Part 191, 10 CFR Part 60, and 10 CFR Part 960?
Key Issue 2	Will the projected releases of radioactive materials to restricted and unrestricted areas and the resulting radiation exposures of the general public and workers during repository operation, closure and decommissioning at Yucca Mountain, meet applicable safety requirements set forth in 10 CFR Part 20, 10 CFR Part 60, 10 CFR Part 960, and 40 CFR Part 191?
Key Issue 3	Can the mined geologic disposal system at Yucca Mountain be sited, constructed, operated, closed, and decommissioned, and can the associated transportation system be sited, constructed, and operated so that the quality of the environment will be protected and waste-transportation operations can be conducted without causing unacceptable risks to public health or safety?
Key Issue 4	Will the construction, operation (including retrieval), closure, and decommissioning of the mined geologic disposal system be feasible at Yucca Mountain on the basis of reasonably available technology, and will the associated costs be reasonable in accordance with the requirements set forth in 10 CFR Part 960?

Table 8.2-2. Site-specific information needs for the Yucca Mountain site (page 1 of 9)

Issues	Information Need No.	Statement of information need
		KEY ISSUE 1
Performance issues		
Issue 1.1: Will the mined geologic disposal system meet the system performance objective for limiting radionuclide releases to the accessible environment as required by 10 CFR 60.112 and 40 CFR 191.13?	1.1.1	Site information needed to calculate releases to the accessible environment
	1.1.2	A set of potentially significant release scenario classes that address all events and processes that may affect the geologic repository
	1.1.3	Calculational models for predicting releases to the accessible environment attending realizations of the potentially significant release scenario classes
	1.1.4	Determination of the radionuclide releases to the accessible environment associated with realizations of potentially significant release scenario classes
	1.1.5	Probabilistic estimates of the radionuclide releases to the accessible environment considering all significant release scenarios
Issue 1.2: Will the mined geologic disposal system meet the requirements for limiting individual doses in the accessible environment as required by 40 CFR 191.15?	1.2.1	Determination of doses to the public in the accessible environment through liquid pathways
	1.2.2	Determination of doses to the public in the accessible environment through gaseous pathway
Issue 1.3: Will the mined geologic disposal system meet the requirements for the protection of special sources of ground water as required by 40 CFR 191.16?	1.3.1	Determination whether any Class 1 or special sources of ground water exist at Yucca Mountain, within the controlled area, or within 5 km of the controlled area boundary
	1.3.2	Determine for all special sources whether concentrations of waste products in the ground water during the first 1,000 years after disposal could exceed the limits established in 40CFR191.16.

Table 8.2-2. Site-specific information needs for the Yucca Mountain site (page 2 of 9)

Issues	Information Need No.	Statement of information need
KEY ISSUE 1 (continued)		
Performance issues (continued) Issue 1.4: Will the waste package meet the performance objective for containment as required by 10 CFR 60.113?	1.4.1	Waste package design features that affect the performance of the container
	1.4.2	Material properties of the container
	1.4.3	Scenarios and models needed to predict the rate of degradation of the container material
	1.4.4	Estimates of the rates and mechanisms of container degradation in the repository environment for anticipated and unanticipated processes and events, and calculation of the failure rate of the container as a function of time
	1.4.5	Determination of whether the requirement for substantially complete containment of the waste packages is met for anticipated processes and events
Issue 1.5: Will the waste package and repository engineered barrier systems meet the performance objective for limiting radionuclide release rates as required by 10 CFR 60.113?	1.5.1	Waste package design features that affect the rate of radionuclide release
	1.5.2	Material properties of the waste form
	1.5.3	Scenarios and models needed to predict the rate of radionuclide release from the waste package and engineered barrier system
	1.5.4	Determination of the release rates of radionuclides from the waste package and engineered barrier system for anticipated and unanticipated events
	1.5.5	Determination of the amount of radionuclides leaving the near-field environment of the waste package

Table 8.2-2. Site-specific information needs for the Yucca Mountain site (page 3 of 9)

Issues	Information Need No.	Statement of information need
	KEY ISSUE 1 (continued)	
Performance issues (continued) Issue 1.6: Will the site meet the performance objective for pre-waste-emplacement ground-water travel time as required by 10 CFR 60.113?	1.6.1	Site information and design concepts needed to identify the fastest path of likely radionuclide travel and to calculate the ground-water travel time along that path
	1.6.2	Calculational models to predict ground-water travel times between the disturbed zone and the accessible environment
	1.6.3	Identification of the paths of likely radionuclide travel from the disturbed zone to the accessible environment and identification of the fastest path
	1.6.4	Determination of the pre-waste-emplacement ground-water travel time along the fastest path of likely radionuclide travel from the disturbed zone to the accessible environment
	1.6.5	Boundary of the disturbed zone
Issue 1.7: Will the performance-confirmation program meet the requirements of 10 CFR 60.137?		Information needs to be determined
Issue 1.8: Can the demonstrations for favorable and potentially adverse conditions be made as required by 10 CFR 60.122?		No additional information needs identified
Issue 1.9: (a) Can the higher-level findings required by 10 CFR Part 960 be made for the qualifying condition of the postclosure system guideline and the disqualifying and qualifying conditions of the technical guidelines for geohydrology, geochemistry, rock characteristics, climate changes, erosion, dissolution, tectonics, and human interference; and (b) can the comparative evaluations required by 10 CFR 960.3-1-5 be made?		No information needs identified.

Table 8.2-2. Site-specific information needs for the Yucca Mountain site (page 4 of 9)

Issues	Information Need No.	Statement of information need
	KEY ISSUE 1 (continued)	
Design issues Issue 1.10: Have the characteristics and configurations of the waste packages been adequately established to (a) show compliance with the postclosure design criteria of 10 CFR 60.135, and (b) provide information for the resolution of the performance issues?	1.10.1	Design information needed to comply with postclosure criteria from 10 CFR 60.135 (a) for consideration of the interactions between the waste package and its environment
	1.10.2	Reference waste package designs
	1.10.3	Reference waste package emplacement configurations
	1.10.4	Postemplacement near-field environment
Issue 1.11: Have the characteristics and configurations of the repository and repository engineered barriers been adequately established to (a) show compliance with the postclosure design criteria of 10 CFR 60.133 and (b) provide information for the resolution of the performance issues?	1.11.1	Site characterization information needed for design
	1.11.2	Characteristics of waste package needed for design of the underground facility
	1.11.3	Design concepts for orientation, geometry, layout, and depth of the underground facility to contribute to waste containment and isolation, including flexibility to accommodate site-specific conditions
	1.11.4	Design constraints to limit water usage and potential chemical changes
	1.11.5	Design constraints to limit excavation-induced changes in rock mass permeability
	1.11.6	Repository thermal loading and predicted thermal and thermomechanical response of the host rock
	1.11.7	Reference postclosure repository design
Issue 1.12: Have the characteristics and configurations of the shaft and borehole seals been adequately established to (a) show compliance with the postclosure design criteria of 10 CFR 60.134 and (b) provide information for the resolution of the performance issues?	1.12.1	Site, waste package, and underground facility information needed for design of seals and their placement methods
	1.12.2	Materials and characteristics of seals for shafts, drifts, and boreholes
	1.12.3	Placement method for seals for shafts, drifts, and boreholes
	1.12.4	Reference design of seals for shafts, drifts, and boreholes

Table 8.2-2. Site-specific information needs for the Yucca Mountain site (page 5 of 9)

Issues	Information Need No.	Statement of information need
	KEY ISSUE 2	
Performance issues		
Issue 2.1: During repository operation, closure, and decommissioning (a) will the expected average radiation dose received by members of the public within any highly populated area be less than a small fraction of the allowable limits and (b) will the expected radiation dose received by any member of the public in an unrestricted area be less than the allowable limits as required by 10 CFR 60.111, 40 CFR 191 Subpart A, and 10 CFR Part 20?	2.1.1	Site and design information needed to assess preclosure radiological safety
Issue 2.2: Can the repository be designed, constructed, operated, closed, and decommissioned in a manner that ensures the radiological safety of workers under normal operations as required by 10 CFR 60.111 and 10 CFR Part 20?	2.2.1	Determination of radiation environment in surface and subsurface facilities due to natural and man-made radioactivity
	2.2.2	Determination that projected worker exposures and exposure conditions under normal conditions meet applicable requirements
Issue 2.3: Can the repository be designed, constructed, operated, closed, and decommissioned in such a way that credible accidents do not result in projected radiological exposures of the general public at the nearest boundary of the unrestricted area, or workers in the restricted area, in excess of applicable limiting values?	2.3.1	Determination of credible accident sequences and their respective frequencies applicable to the repository
	2.3.2	Determination of the predicted releases of radioactive material and projected public and worker exposures and exposure conditions under accident conditions and that these meet applicable requirements

Table 8.2-2. Site-specific information needs for the Yucca Mountain site (page 6 of 9)

Issues	Information Need No.	Statement of information need
	KEY ISSUE 2 (continued)	
Performance issues (continued)		
Issue 2.4: Can the repository be designed, constructed, operated, closed, and decommissioned so that the option of waste retrieval will be preserved as required by 10 CFR 60.111?	2.4.1	Site and design data required to support retrieval
	2.4.2	Determination that access to the waste emplacement boreholes can be provided throughout the retrievability period for normal and credible abnormal conditions
	2.4.3	Determination that access to the waste packages can be provided throughout the retrievability period for normal and credible abnormal conditions
	2.4.4	Determination that the waste can be removed from the emplacement boreholes for normal and off-normal conditions
	2.4.5	Determination that the waste can be transported to the surface and delivered to the waste-handling surface facilities for normal and credible abnormal conditions
	2.4.6	Determination that the retrieval requirements set forth in 10 CFR 60.111(b) are met using reasonably available technology
Issue 2.5: Can the higher-level findings required by 10 CFR Part 960 be made for the qualifying condition of the preclosure system guideline and the disqualifying and qualifying conditions of the technical guidelines for population density and distribution, site ownership and control, meteorology, and offsite installations and operations?		No additional information needs identified

Table 8.2-2. Site-specific information needs for the Yucca Mountain site (page 7 of 9)

Issues	Information Need No.	Statement of information need
	KEY ISSUE 2 (continued)	
Design issues Issue 2.6: Have the characteristics and configurations of the waste packages been adequately established to (a) show compliance with the preclosure design criteria of 10 CFR 60.135 and (b) provide information for the resolution of the performance issues?	2.6.1	Design information needed to comply with preclosure criteria from 10 CFR 60.135(b) for materials, handling, and identification of waste packages
	2.6.2	Design information needed to comply with preclosure criteria from 10 CFR 60.135(c) for waste forms
	2.6.3	Waste acceptance specifications
Issue 2.7: Have the characteristics and configurations of the repository been adequately established to (a) show compliance with the preclosure design criteria of 10 CFR 60.130 through 60.133 and (b) provide information for the resolution of the performance issues?	2.7.1	Determination that the design criteria in 10 CFR 60.131 through 60.133 and any additional appropriate design objectives pertaining to radiological protection have been met
	2.7.2	Determination that the design criteria in 10 CFR 60.131 through 60.133 and any additional appropriate design objective pertaining to the design and protection of structures, systems, and components important to safety have been met
	2.7.3	Determination that the design criteria in 10 CFR 60.131 through 60.133 and any appropriate additional design objectives pertaining to criticality control have been met
	2.7.4[a]	Determination that the design criteria in 10 CFR 60.131 through 60.133 and any appropriate additional design objectives pertaining to compliance with mining regulations have been met
	2.7.5[a]	Determination that the design criteria in 10 CFR 60.131 through 60.133 and any appropriate additional design objectives pertaining to waste treatment have been met

Table 8.2-2. Site-specific information needs for the Yucca Mountain site (page 8 of 9)

Issues	Information Need No.	Statement of information need
	KEY ISSUE 4	
Performance issues		
Issue 4.1: Can the higher-level findings required by 10 CFR Part 960 be made for the qualifying condition of the preclosure system guideline and the disqualifying and qualifying conditions of the technical guidelines for surface characteristics, rock characteristics, hydrology, and tectonics?		No additional information needs identified
Design issues		
Issue 4.2: Are the repository design and operating procedures developed to ensure nonradiological health and safety of workers adequately established for the resolution of the performance issues?	4.2.1	Site and performance assessment information needed for design
Issue 4.3: Are the waste package production technologies adequately established for the resolution of the performance issues?	4.3.1	Identification and evaluation of production technologies for fabrication, closure, and inspection of the waste package
Issue 4.4: Are the technologies of repository construction, operation, closure, and decommissioning adequately established to support resolution of the performance issues?	4.4.1	Site and performance assessment information needed for design
	4.4.2	Characteristics and quantities of waste and waste packages needed for design
	4.4.3	Plan for repository operations during construction, operation, closure, and decommissioning
	4.4.4	Repository design requirements for construction, operation, closure, and decommissioning
	4.4.5	Reference preclosure repository design
	4.4.6	Development and demonstration of required equipment
	4.4.7	Design analyses, including those addressing impacts of surface conditions, rock characteristics, hydrology, and tectonic activity

Table 8.2-2. Site-specific information needs for the Yucca Mountain site (page 9 of 9)

Issues	Information Need No.	Statement of information need
	KEY ISSUE 4 (continued)	
Design issues (continued)	4.4.8	Identification of technologies for surface facility construction, operation, closure, and decommissioning
	4.4.9	Identification of technologies for underground facility construction, operation, closure, and decommissioning
	4.4.10	Determination that the seals for shafts, drifts, and boreholes can be emplaced with reasonably available technology
Issue 4.5: Are the costs of the waste packages and the repository adequately established for the resolution of the performance issues?[b]	4.5.1	Estimate the costs of the reference and alternative waste packages
	4.5.2	Estimate the costs of the reference and alternative repository designs
	4.5.3	Estimate the life cycle costs of the reference and alternative total system design

[a]Information need does not require site-specific data.
[b]Resolution of Issue 4.5 is not required as the Yucca Mountain site is the only site under consideration for development as a repository as designated by the Nuclear Waste Policy Amendments Act of 1987 (NWPAA, 1987).

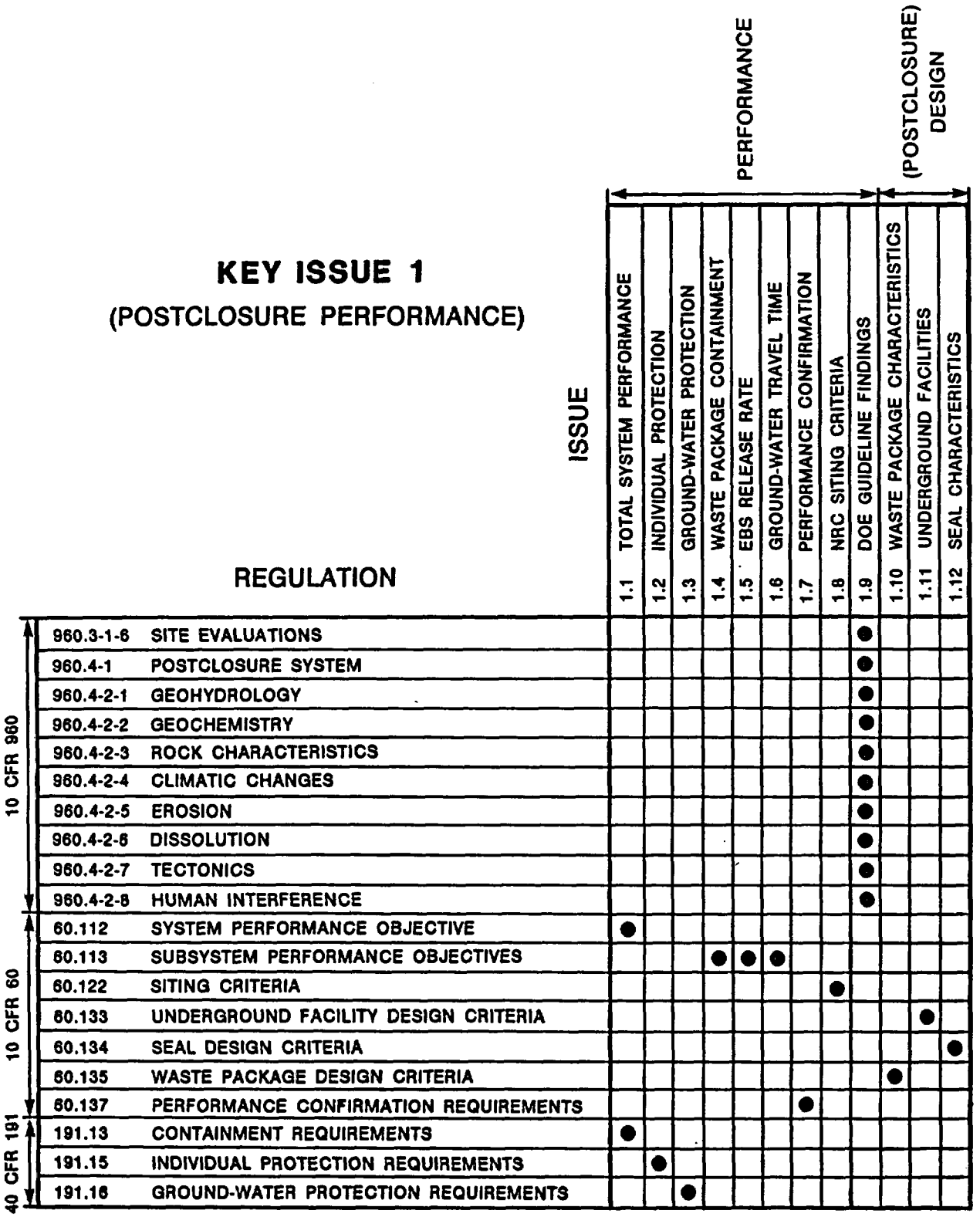

Figure 8.2-1. Correlation of performance and design issues for Key Issue 1 (postclosure performance) with regulatory requirements.

KEY ISSUE 2
(PRECLOSURE RADIOLOGICAL SAFETY)

	REGULATION		ISSUE	2.1 PUBLIC RADIOLOGICAL EXPOSURES–NORMAL CONDITIONS	2.2 WORKER RADIOLOGICAL SAFETY–NORMAL CONDITIONS	2.3 ACCIDENTAL RADIOLOGICAL RELEASES	2.4 RETRIEVABILITY	2.5 DOE GUIDELINE FINDINGS-RADIOLOGICAL SAFETY	2.6 WASTE PACKAGE CHARACTERISTICS	2.7 REPOSITORY DESIGN CRITERIA FOR RADIOLOGICAL SAFETY
			PERFORMANCE	←				→		(PRECLOSURE) DESIGN
10 CFR 960	960.5-1	PRECLOSURE SYSTEM–RADIOLOGICAL SAFETY						●		
	960.5-2-1	POPULATION						●		
	960.5-2-2	SITE OWNERSHIP						●		
	960.5-2-3	METEOROLOGY						●		
	960.5-2-4	OFFSITE INSTALLATIONS						●		
10 CFR 60	60.111	RADIOLOGICAL PROTECTION AND RETRIEVABILITY		●	●		●			
	60.131	GENERAL DESIGN CRITERIA								●
	60.132	PRECLOSURE RADIOLOGICAL DESIGN								●
	60.133	UNDERGROUND FACILITY DESIGN CRITERIA								●
	60.135	WASTE PACKAGE DESIGN CRITERIA							●	
	40 CFR 191, SUBPART A	STANDARDS FOR MANAGEMENT		●						
	10 CFR 20	RADIATION PROTECTION STANDARDS		●	●					

Figure 8.2-2. Correlation of performance and design issues for Key Issue 2 (preclosure radiological safety) with regulatory requirements.

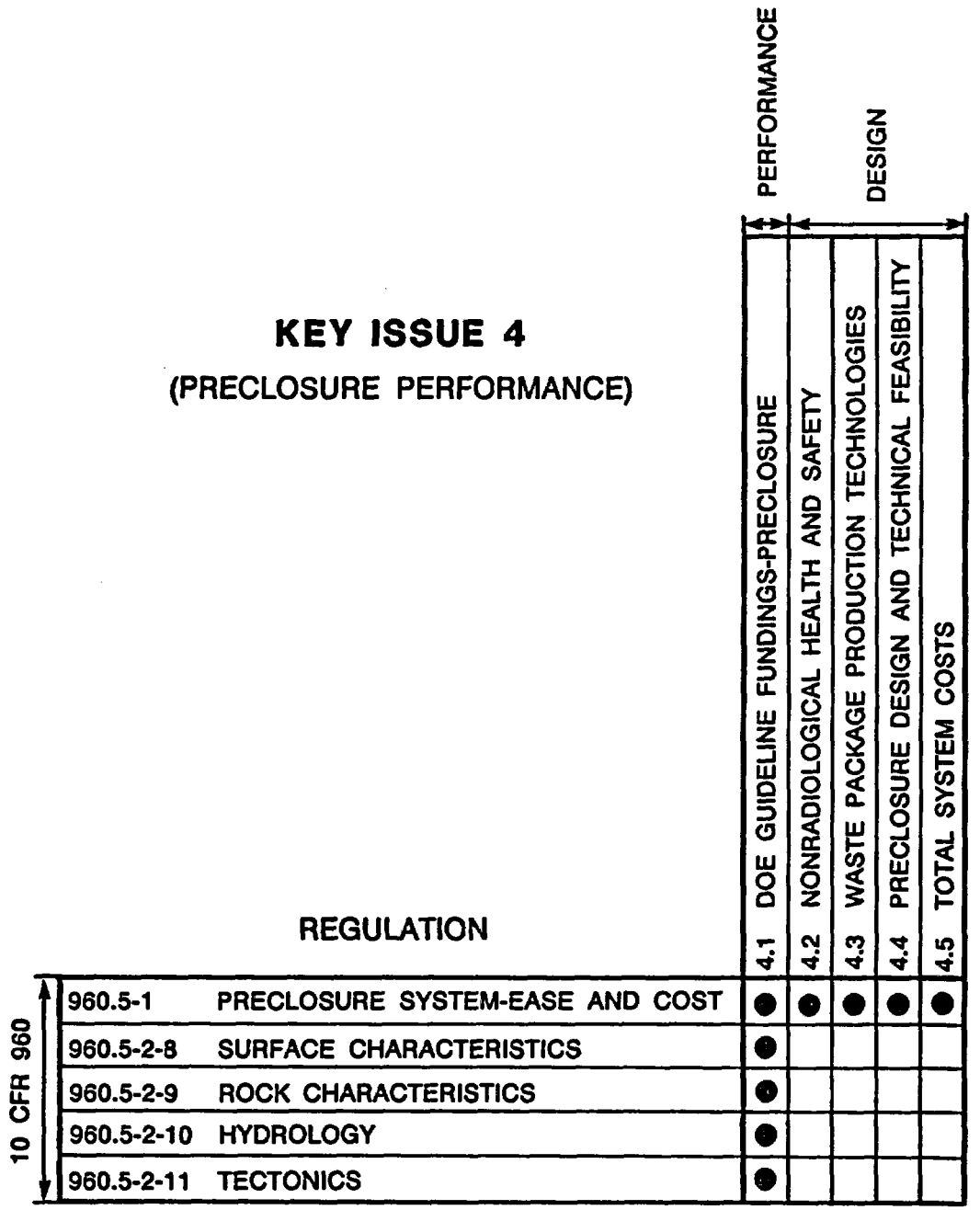

Figure 8.2-3. Correlation of performance and design issues for Key Issue 4 (preclosure performance) with regulatory requirements.

This system definition is called the Yucca Mountain mined geologic disposal system (MGDS) (Figure 8.2-4) and serves as a basis for a functional description of the repository. The physical elements of the Yucca Mountain MGDS are the natural site features, engineered features, and institutional features arranged in a hierarchical format. These elements are the components of the system that are used as the basis for developing issue resolution strategies. As shown in Figure 8.2-4, the highest level categorization of the MGDS results in elements related to either the preclosure or postclosure waste disposal systems. Within the preclosure element, the next level in the hierarchy is composed of three elements--site, repository, and waste emplacement package. At a similar level within the postclosure waste disposal element are natural barriers, engineered barriers, and institutional barriers. Further subdivisions of the MGDS are shown in Figure 8.2-4.

As described in Section 8.1.2, the first step in developing an issue resolution strategy for a performance or design issue is to select the system element upon which reliance will be placed. As a part of issue resolution, performance allocation has been used as a means for focusing site characterization on acquisition of data that will be most useful in demonstrating that reliance on a particular element of the MGDS will result in acceptable repository designs and performance. Sections 8.3.2 through 8.3.5 provide complete discussions of each issue resolution strategy summarized in this section.

8.2.1.1 Site-specific issues hierarchy

Table 8.2-2 provides the Yucca Mountain Project site-specific information needs within the context of the OGR issues hierarchy. Information needs were developed as convenient categories of data, parameters, and other information items necessary to support resolution of performance and design issues. Information needs include calculational models, descriptions of processes, and information about conditions and characteristics of the site and the engineered repository system. Those information needs requiring site data are described in detail in Sections 8.3.2 through 8.3.5. Site data will be, in turn, provided by site programs described in Sections 8.3.1.2 through 8.3.1.17.

8.2.1.2 Other issues

The wording of the OGR issues (DOE, 1986d) differs slightly from the wording of issues in the DOE Mission Plan (DOE, 1985b). A correlation matrix provided in Figure 8.2-5 shows that all issues in the DOE Mission Plan are addressed by one or more of the OGR issues.

Although this site characterization plan has been developed and is organized on the basis of the OGR issues, specific technical concerns related to site suitability for repository development and repository performance that have been raised by the public and the NRC have been addressed. The matrices in Tables 8.2-3 and 8.2-4 provide a correlation to the appropriate section in this document where specific technical concerns are addressed.

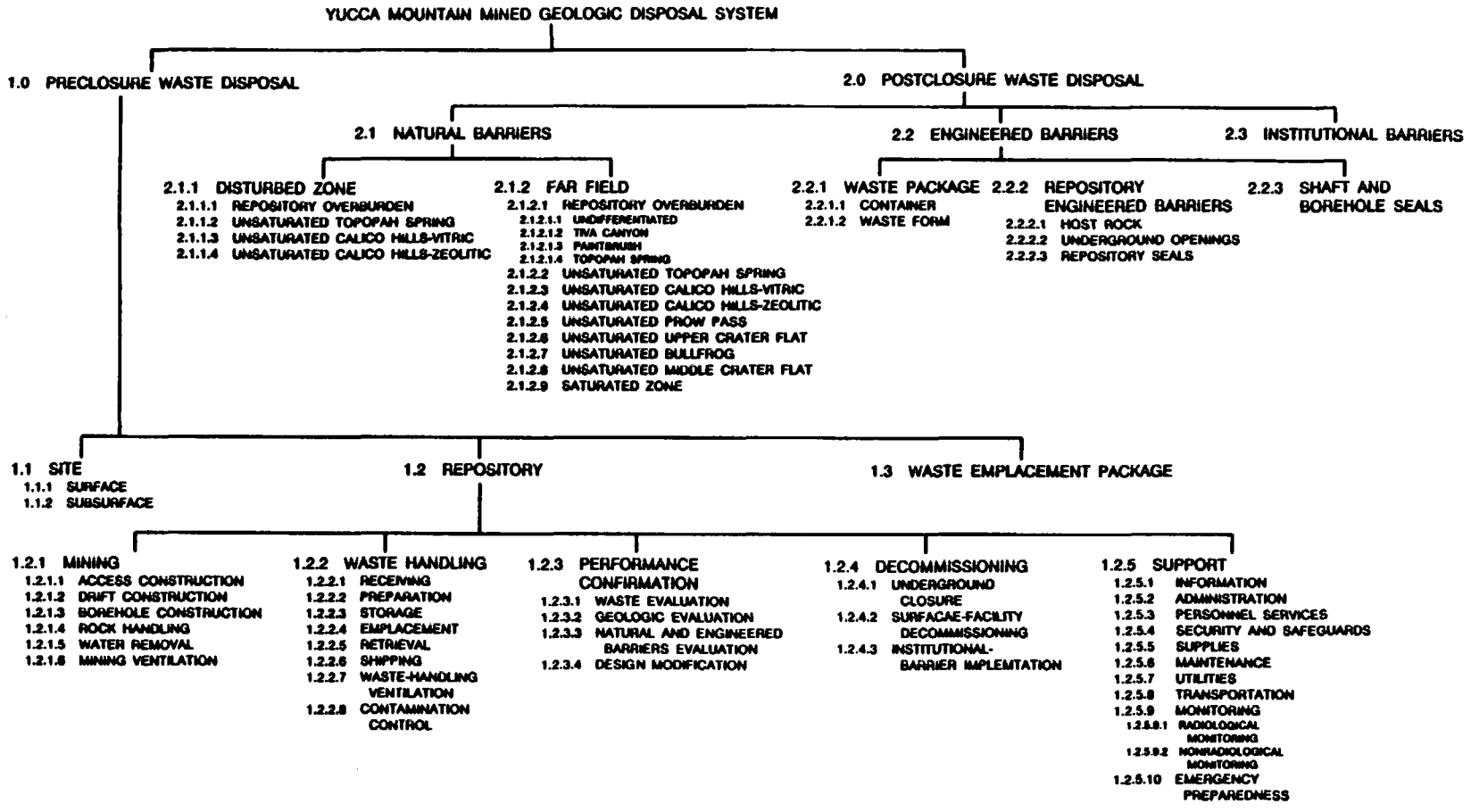

Figure 8.2-4. Hierarchy of functions and components that make up the Yucca Mountain mined geologic disposal system.

OGR ISSUES	MISSION PLAN ISSUES	1.1 GEOHYDROLOGY	1.2 GEOCHEMISTRY	1.3 ROCK CHARACTERISTICS	1.4 EROSION	1.5 CLIMATE	1.6 DISSOLUTION	1.7 TECTONICS	1.8 HUMAN ACTIVITIES	1.9 WASTE PACKAGE & ENGINEERED BARRIER SYSTEM	2.1 RADIOLOGICAL SAFETY-PUBLIC	2.2 METEOROLOGY	2.3 OFFSITE ACTIVITIES	2.4 WORKER RADIOLOGICAL SAFETY	4.1 WASTE PACKAGE COST EFFECTIVENESS	4.2 SURFACE CHARACTERISTICS	4.3 ROCK THERMAL & MECHANICAL CHARACTERISTICS	4.4 PRECLOSURE HYDROLOGY	4.5 PRECLOSURE TECTONICS	4.6 OVERALL REPOSITORY COST-EFFECTIVENESS	4.7 COST-EFFECTIVE CLOSURE
1.1	RELEASES TO ACCESSIBLE ENVIRONMENT	●	●			●		●	●	●											
1.2	INDIVIDUAL PROTECTION	●																			
1.3	GROUND-WATER PROTECTION	●																			
1.4	WASTE PACKAGE CONTAINMENT									●											
1.5	RELEASE RATE		●							●											
1.6	GROUND-WATER TRAVEL TIME	●																			
1.7	PERFORMANCE CONFIRMATION									●							●				
1.8	NRC SITING CRITERIA	●	●	●	●	●	●	●	●												
1.9	DOE GUIDELINE FINDINGS - POSTCLOSURE	●	●	●	●	●	●	●	●	●											
1.10	WASTE PACKAGE		●					●		●							●				
1.11	REPOSITORY	●		●				●									●				
1.12	SEALS	●																●			
2.1	PUBLIC SAFETY-NORMAL OPERATION										●	●	●								
2.2	WORKER SAFETY											●	●	●							
2.3	PUBLIC SAFETY DURING ACCIDENTS										●	●	●	●							
2.4	RETRIEVABILITY			●										●			●				
2.5	DOE GUIDELINE FINDINGS - RADIOLOGICAL SAFETY										●	●	●	●							
2.6	WASTE PACKAGE DESIGN		●												●						
2.7	REPOSITORY DESIGN										●	●	●	●		●	●	●	●		
4.1	DOE GUIDELINE FINDINGS - AVAILABLE TECHNOLOGY														●	●	●	●	●	●	●
4.2	NONRADIOLOGICAL WORKER SAFETY															●	●	●	●		
4.3	WASTE PACKAGE PRODUCTION									●					●						
4.4	ADEQUACY OF TECHNOLOGY											●			●	●	●	●	●	●	●
4.5	COSTS														●	●	●	●	●	●	●

Figure 8.2-5. Correlation of the Department of Energy Mission Plan issues and Office of Geologic Repositories (OGR) issues.

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 1 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
			HYDROLOGY		
EA CRD[a]	3.1.1.3	Hydraulic features	Impacts of hydraulic features on system performance	2.2.2 Mechanical properties of discontinuities in rocks	Covers fractures, joints, and effects of water
				8.3.1.4.2 Spatial distribution of thermal and mechanical properties	References thermal and mechanical properties needed for other information needs
EA CRD	3.1.1.4	Intention of guidelines	Technical approach	8.3.5.6, 8.3.5.7, 8.3.5.18 Technical basis for DOE higher level findings issues 1.9, 2.5, 4.1	Technical basis addressed individually for issues throughout Chapter 8
EA CRD	5.3	Matrix and fracture flow	Proportion of fractures vs matrix flow unknown	3.9.2.2.2 Transmissivity and hydraulic conductivity	Contains existing material on fracture vs matrix flow

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 2 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
			HYDROLOGY (continued)		
EA CRD (continued)				8.3.1.2.1.3 Characterization of regional groundwater flow system	Activities including fracture vs matrix flow
EA CRD	5.4	Basin boundary	Effects of climatic on hydrologic conditions due to boundary conditions of basins	1.1 Geomorphology	Discusses Great Basin geology
ISTP(1)[b]	1.5	Effects on ground water	Natural changes affecting groundwater flow	8.3.1.5.2.2 Climatic effects on hydrology	Studies on the effects of climate on hydrologic characteristics
EA CRD	3.1.3.2	Unsaturated zone hydrology	Unsaturated zone data base is inadequate	3.9 Site hydrogeologic system	Includes unsaturated zone monitoring and characteristics
EA CRD	4.1.2.2	Ground-water travel time (GWTT)	Tritium analyses	8.3.1.2.2.1 Characterization of unsaturated zone infiltration	Studies include hydrologic characteristics and future infiltration

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 3 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
			HYDROLOGY (continued)		
EA CRD (continued)			Determine flux value	3.9.4 GWTT in the unsaturated zone	Contains preliminary unsaturated zone travel-time calculation and basis for flux estimate
EA CRD	8.3	Perched water	Improve data base on perched water	8.3.1.2.2.3, 8.3.1.2.2.4 Characterization of percolation in the unsaturated zone	Activities include drilling (locating perched water zones) and testing any perched water encountered
NRC comment Final EA[c]	7	Uniform infiltration	Uniform infiltration does not allow for preferential paths	8.3.1.2 Geohydrology	Contains summary of current hypotheses, uncertainties, and alternative hypotheses
NRC comment Final EA	7	Flux values	Adequate evaluation of flux values	3.9.4 GWTT in the unsaturated zone	Contains preliminary unsaturated-zone travel-time calculation and basis for flux estimate

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 4 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
			HYDROLOGY (continued)		
NRC comment draft EA[d]	3	Ground-water travel time	Uncertainties, alternative models	8.3.1.2 Geohydrology	Contains summary of current hypotheses, uncertainties, and alternative hypotheses
EA CRD	5.1	Saturated and unsaturated zone hydrology	Further characterization of the saturated and unsaturated zone hydrology	3.6 to 3.8 Hydrology	Includes existing information on regional ground water of the site
EA CRD	5.1	Ghost Dance fault.	Potential for Ghost Dance fault as a fluid conduit	8.3.1.2 Geohydrology (postclosure)	Contains studies of the regional, unsaturated, and saturated zones of the site
EA CRD	5.1	Water table	Water table profile	8.3.1.2.1.3.2, 8.3.1.2.3.1.2 Regional and site potentiometric-level studies	Activities include monitoring and assessment of potentiometric level

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 5 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
			HYDROLOGY (continued)		
EA CRD	7.2	Ground-water basins	Further characterization of Devils Hole basin	8.3.1.16.2.1 Location of adequate water supply	Activities include evaluation of potential effects of ground-water withdrawals on the flow system
PHPR[e]	1.02.02	Hydrologic system	Identify ground-water flow paths, rates, and fluxes	3.9 Site hydrogeologic system	Covers material on flow paths, rates, and fluxes
ISTP(1)	1.1	Hydrology	Nature of present hydrology	Chapter 3 Hydrology	Current information on hydrology
NRC comment Final EA	4	Hydrothermal activity	Hydrothermal activity affecting flow paths	1.5.2.1 Effects of faulting	Potential effects of faulting
PHPR	1.02.03	Hydrologic system	Effects of fractures and structural features on flow paths	3.7.2 Principal ground-water flow paths	Covers existing material on ground-water flow paths
				8.3.1.8.3 Studies of changes in hydrology due to tectonic processes	Activities include evaluation of effects of igneous and tectonic processes on hydrology

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 6 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
			HYDROLOGY (continued)		
PHPR (continued)				8.3.1.3.2 Mineralogy, petrology, and rock chemistry	Activities include analyses of fracture mineralogy
EA CRD	4.1.2.2	Aquifers	Flow between aquifers	3.6 Regional hydrology	Includes existing information on hydrogeologic units and their interrelationships
NRC comment Final EA	7(4)	Hydrogeologic properties	Interrelationships of hydrogeologic properties	3.6 Regional hydrology	Includes existing information on hydrogeologic units and their interrelationships
PHPR	1.02.04	Aquifer flow	Flow between aquifers	8.3.1.2.1 Regional hydrology	Includes studies for hydraulic head and gradient
PHPR	1.02.05	Discharge and recharge	Location of natural discharge and recharge areas	3.7.1 Identification of discharge and recharge areas	Contains current information on recharge and discharge areas

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 7 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
			HYDROLOGY (continued)		
PHPR	1.02.09	Amargosa Valley	Hydrologic relationship with the Amargosa Valley River system	8.3.1.2 Studies of of the hydrologic system	Includes studies of discharge and recharge areas
PHPR	1.02.06	Flow paths and rates	Identify the flow paths and rates to the accessible environment	3.9 Site hydrogeologic system	Covers material on flow paths, rates, and fluxes
PHPR	1.02.11	Hydrology transport model	Information necessary for the hydrologic transport model	8.3.1.2, 8.3.1.3 Geohydrology, geochemistry	Includes studies to provide information on hydrology, geochemistry, and transport characteristics
PHPR	1.02.29	Tectonic alteration	Potential for tectonic alteration of ground-water flow path	8.3.1.8.3 Studies of changes in hydrology due to tectonic processes	Activities include evaluation of effects of igneous and tectonic processes on hydrology

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 8 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
			HYDROLOGY (continued)		
PHPR	1.02.07	Seismic effects on ground-water travel time	Effects of seismicity on ground-water travel time	1.5.2.1 Effects of faulting	Discusses the potential effects of faulting
				8.3.5.12 Assessment of ground-water travel time	Activities include calculation of ground-water travel time
PHPR	1.02.08	Effects of exploration	Effects of exploratory drilling on ground-water travel time	3.7 Regional ground-water flow system	Describes flow system
				8.3.1.9.3 Human intrusion	Studies exploration effects on hydrology
PHPR	1.02.18	Human intrusion	Potential of mining intrusion of repository	8.3.1.9.3 Human intrusion	Studies exploration effects on hydrology
ISTP(1)	1.6	Human intrusion	Effects of human intrusion on hydrology	8.3.1.9.3 Human intrusion	Studies exploration effects on hydrology

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 9 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
			HYDROLOGY (continued)		
PHPR	1.02.10	Radionuclide transport	Potential for radionuclide transport through the flow system	8.3.5.13 Radionuclide releases	Assesses radiological releases to accessible environment
PHPR	1.09.11	Site characterization information	Benefit of site characterization information to surrounding area	Chapters 1 to 5	Contains existing site information
PHPR	1.11.04	Site characterization activities	Detailed descriptions of site characterization activities	8.3.1 Site program	Contains site information needed
PHPR	1.12.01	Detailed information	Development of detailed site information	8.3.1 Site program	Contains site information needed
PHPR	1.12.03	Issue resolution	Description of issues to be resolved during site characterization	8.3.5 Performance assessment	Contains strategies for issues resolution

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 10 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
			HYDROLOGY (continued)		
PHPR	1.02.01	Site-qualifying hydrologic issues	Identify site-qualifying hydrologic issues examined during site characterization	Chapter 3 Hydrology	Current information on hydrology
				8.3.5.18 Higher-level findings	Findings required for technical guidelines
PHPR	1.02.17	Pluvial conditions	Effects of pluvial climate on unsaturated zone	5.2.2 Future climate variation	Includes climate prediction and model validation
ISTP(1)	1.3	Natural changes	Natural (climatic) changes altering ground-water flow	8.3.1.5 Climatic change	Includes effects of climate on site elements
PHPR	1.02.27	Ground-water migration	Ground-water migration in the Great Basin	1.1 Geomorphology	Discusses Great Basin geology
				8.3.1.2.1.3 Regional ground-water flow system	Includes recharge and potentiometric level studies

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 11 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
			GEOLOGY: MECHANICS		
PHPR	1.02.28	Radionuclide migration	Characterization of radionuclide migration in the unsaturated zone	8.3.5.13.5 Probabilistic radiological releases to the accessible environment	Radiological releases from anticipated and unanticipated scenarios
EA CRD	3.4.1.4	Porosity	Large-scale porosity tests	2.4.2.4 Porosity and density	Provides existing information on porosity and density
				8.3.1.15.1.1 Density and porosity characterization	Includes studies characterizing rock density and porosity
EA CRD	3.4.1.4	Fracturing	Thermally induced fracturing	2.4 Thermal and thermomechanical properties--intact rock	Provides existing information on thermal properties of intact rock
				8.3.1.15.1.6 Thermal properties from in situ experiments	Thermal properties from in situ experiments

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 12 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
			GEOLOGY: MECHANICS (continued)		
EA CRD	4.1.1	Regional stress regime	Lack of information on the regional stress regime	2.6 Existing stress regime	Regional and site stress regime
EA CRD	8.2	Rock properties	In situ rock properties and stress	8.3.1.15.2 Ambient stress	Studies cover in situ stress testing
EA CRD	5.3	Thermo-mechanical properties of rock	Limitations of models	2.4 to 2.5 Thermal and thermomechanical properties of rock	Includes existing material on thermo-mechanical properties of rock
			Effects of percentages of lithophysae on thermomechanical properties of the in situ rock	8.3.1.15.1 Thermal and mechanical properties of rock	Studies to determine the thermal and mechanical properties of the in situ rock
EA CRD	8.2	Rock properties	Topopah Spring vs Grouse Canyon rock properties	1.8.2.1 Relation of geology to repository design	Includes repository operations
PHPR	1.01.08	Tuff properties	Integrity of tuff maintained during repository operations	Chapter 2 Geoengineering	Provides existing material on large scale rock properties

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 13 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
			GEOLOGY: MECHANICS (continued)		
PHPR (continued)				8.3.1.15.1 Thermal and mechanical properties	Studies provide information on thermal and mechanical properties
PHPR	1.02.30	Characterization effects	Effects of characterization on the integrity host rock	8.3.3.2 Borehole seals	Designs for borehole seals
				8.3.5.12.3 Disturbed zone ground-water travel time	Ground-water travel time resulting from characterization
			GEOLOGY: SURFACE CONDITIONS		
EA CRD	4.1.1	Surface conditions	Soil conditions, wind and water erosion	1.1.3.2 Erosion rates	Provides information on average erosion rates at the site
				8.3.1.14.2 Soil and bedrock properties	Studies include physical properties of soil

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 14 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
			GEOLOGY: SURFACE CONDITIONS (continued)		
EA CRD (continued)				8.3.1.6.2.1 Future climatic conditions on the nature and rate of erosion	Studies include wind and water erosion
				8.3.1.6 Erosion	States erosion will not affect the minimum burial depth
EA CRD	5.4	Erosion	Further data on erosion rates needed	1.1.3.2 Erosion rates	Existing material on erosion rates of site and area
EA CRD	4.1.2.1	Flooding	Maximum probable flood	3.2.1 Floods	Contains flood history and potential for future flooding
EA CRD	8.1	Flooding	Probable maximum flood	8.3.1.16.1 Flood recurrence levels and intervals	Includes studies for the characterization of flood potential

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 15 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
			GEOLOGY: SURFACE CONDITIONS (continued)		
EA CRD	4.1.3.3	Precipitation and evapotranspiration	Annual precipitation and evapotranspiration rates and variations	3.9.3.3 Recharge and discharge	Includes information on evapotranspiration and precipitation
				8.3.1.2.1 Regional hydrology	Contains studies for precipitation and evapotranspiration data
EA CRD	4.1.3.3	Climatic regime	Detail of the climatology and meteorology of the site	5.1 to 5.2 Recent and long-term climate and meteorology	Provides existing information on climatic regime
EA CRD	7.2	Climatic regime	Further study of the climatic regime	8.3.1.5.1 Future climatic conditions	Studies provide information required for prediction of future climatic conditions
				8.3.1.12.1 Meteorological conditions at the site	Studies provide data on regional meteorological conditions

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 16 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
			GEOLOGY: SURFACE CONDITIONS (continued)		
EA CRD	6.3	Meteorology	Data on extreme weather conditions	5.1 to 5.2 Recent and long-term meteorology and climate	Provides existing information on meteorological conditions
				8.3.1.12.1 Meteorological conditions at the site	Includes studies on extreme weather
				8.3.1.12.4 Recurrence intervals of extreme weather	Activities provide data on extreme weather and their recurrence intervals
EA CRD	4.1.3.7	Background radiation	Radiation levels in soil and water	4.1.2.6 Background radioactivity	Includes information on ground-water background radioactivity
EA CRD	6.5	Natural radiation	Natural radiation hazard	8.3.5.4.1 Natural radiation environment	References studies to determine the natural radiation environment

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 17 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
			GEOLOGY: SURFACE CONDITIONS (continued)		
EA CRD	4.1.3.1	Land use	Detailed studies of land use	8.3.1.11.1.2 Land ownership and control	Includes interactions with the Department of Interior and Bureau of Land Management
EA CRD	5.8	Future communities	Development of future communities	8.3.1.10 Population patterns and forecasts	Includes studies on population pattern development
PHPR	1.02.25	Drainage patterns	Effects of alteration of drainage pattern	8.3.1.2.1 Descriptions of surface hydrology	Includes recharge and discharge flooding
ISTP(1)	1.2	Surface water	Nature of present surface water system	3.1 Surface hydrology	Current information on surface hydrology
			GEOLOGY: TECTONICS AND MINERALOGY		
EA CRD	5.7	Seismic patterns	Increase seismic pattern data base	1.4 Seismology of the site	Provides existing material on seismic patterns of the area

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 18 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
			GEOLOGY: TECTONICS AND MINERALOGY (continued)		
EA CRD (continued)				8.3.1.17.4.1 Seismology	Contains seismologic data compilation
EA CRD	5.6	Secondary volcanism	Significance of secondary volcanic processes	1.3.2.1 Volcanic history	Includes the volcanic history and petrology of the site
				8.3.1.8.1 Studies on releases resulting from volcanic activity	Studies to provide information on releases resulting from volcanic activity
EA CRD	5.2	Lateral and vertical extent	Inadequate information on the usability of areas outside the primary area	1.2 Stratigraphy and lithology	Provides existing material on stratigraphy and lithology
				8.3.1.4.2 Stratigraphy and structure	Contains activities on the extent of lithologic units
EA CRD	5.2	Fracture mineralogy	Lack of information on fracture mineralogy	4.1.1.3.1.2 Mineralogy of fractures	Contains existing information on fracture mineralogy

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 19 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
		GEOLOGY: TECTONICS AND MINERALOGY (continued)			
EA CRD	3.1.3.2	Postclosure tectonics	Tilting and warping rates and directions	1.1.3 Geomorphic processes	Covers significant late Quaternary geomorphic processes
NRC comment Final EA	1	Fault activity	Movement of north trending faults within the last 1,000 yr	1.3.2.2.2. Structure of Yucca Mountain	Current information on structural history of Yucca Mountain
NRC comment Final EA	2	Northeast trending faults	Relationship of northeast trending faults to younger basaltic activity	8.3.1.17.4.5 Detachment faults	Activities to provide data on detachment faults
NRC comment Draft EA	1	Northeast trending and fault activity	Northeast trending faults and fault activity	8.3.1.17.4.7 Geometry of faults	Activities to provide data on subsurface geometry and concealed extensions of faults
				8.3.1.8.1.2 Effects of eruptions	Activities provide analyses of effects of volcanic eruptions

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 20 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
		GEOLOGY:	TECTONICS AND MINERALOGY (continued)		
EA CRD	3.4.1.8	Seismic hazards	Site-specific estimates of seismic hazards	1.4.1.5 Seismic hazards at the candidate site	Provides existing information on seismic hazards
PHPR	1.01.03	Seismic activity	Potential for and associated uncertainties of seismic activity	8.3.1.17 Tectonic and igneous events	Studies include estimates of the probability of future earthquakes and faulting
PHPR	1.01.04	Seismic disruption	Estimated potential for seismic disruption of the repository	8.3.1.17.3 Ground motion	Studies to provide information on the effects of vibration ground motion on the repository
PHPR	1.01.05	Distance to fault	Determine a safe distance to a fault	8.3.1.8.2 Tectonic processes	Studies include probilities of rupture
				8.3.1.17.2 Potential fault movement	Studies include assessment of faulting potential
NRC comment Draft EA	2	Volcanism and hydrothermal activity	Origin of calcite-silicate vein deposits	8.3.1.3.2.1 Fracture mineralogy	Contains activity on determining fracture mineralogy

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 21 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
			GEOLOGY: TECTONICS AND MINERALOGY (continued)		
NRC Comment Draft EA (continued)				8.3.1.5.2 Future climate	Contains studies on calcite and silicates
				1.3.2.2.2 Structure of Yucca Mountain	Contains information on the structural history of Yucca Mountain
EA CRD	5.3	Fault density	Actual fault density	1.5.2.1 to 1.5.2.3 Faulting effects, likelihood, and relation to weapons tests	Contains information on fault types, locations, and effects
NRC comment Final EA	3	Detachment faulting	Potential for the presence of detachment faults and other fault movement	8.3.1.17 Tectonic and igneous events	Includes studies on detachment faults and potential fault movement
		Faulting styles	Fault movement styles of Yucca Mountain	8.3.1.17.4 Tectonics data collection	Studies to provide data on past and present faulting and seismicity

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 22 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
		GEOLOGY: TECTONICS AND MINERALOGY (continued)			
NRC comment Draft EA	1	Detachment faulting	Studies addressing detachment faulting	8.3.17.4.5 Detachment faults	Activities to provide data on detachment faults
PHPR	1.01.06	Fault source	Faulting resulting from weapons tests	8.3.1.13.2 Impact of nearby installations and operations	Includes effects of weapons testing
PHPR	1.07.03	Dust generated	Potential for hazardous fibers within dust	4.1 Geochemistry of the host rock	Discusses mineralogy of host rock
				8.3.1.3.2 Mineralogy petrology, chemistry of the host rock	Determines material constituency of host rock
EA CRD	5.8	Mineral resource	Further mineral resource evaluations	1.7 Mineral and hydrocarbon resources	Provides existing information on mineral resources
		Geothermal	Potential for extraction of geothermal resources	8.3.1.9.2 Value of resources	Includes studies on resource value

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 23 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
		GEOLOGY: TECTONICS AND MINERALOGY (continued)			
NRC Comment Final EA	5	Economic deposits	Potential for economic deposits associated with calderas	8.3.1.9.3 Effects of exploiting natural resources	Studies to provide information on the potential effects of exploiting natural resources
		Breccia deposits	Potential for economic deposits associated with breccias	8.3.1.9.2.1 Present and future value of natural resources	Includes activities to assess natural resources
NRC comment Draft EA	2	Natural resources	Potential for undiscovered mineral resources	8.3.1.5.2 Future climate	Contains studies on calcite and silicate deposits
PHPR	1.01.07	Mineral resources	Presence of mineral resources	8.3.1.16.2 Identification of water supplies	Includes identification, assessment, and effects of water supply exploitation
ISTP(1)	1.4	Ground-water withdrawal	Water resource development	8.3.1.16.2 Identification of water supplies	Includes identification, assessment, and effects of water supply exploitation

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 24 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
		GEOLOGY:	TECTONICS AND MINERALOGY (continued)		
PHPR	1.01.01	Geologic system	Present nature of geologic system	Chapter 1 Geology	Chapter 1 contains current geology material
ISTP(5)[f]	5.1	Site-qualifying geology issues	Determine site-qualifying issues examined during site characterization	8.3.5.18 Higher level findings	Issue resolution strategy for higher-level findings on qualifying and disqualifying conditions
	5.2	Future geology	Future changes altering geology	8.3.5.18 Higher-level findings	Issue resolution strategy for higher-level findings on qualifying and disqualifying conditions
	5.3	Geologic system	Human-induced changes altering geology	8.3.5.18 Higher-level findings	Issue resolution strategy for higher-level findings on qualifying and disqualifying conditions

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 25 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
		GEOLOGY: TECTONICS AND MINERALOGY (continued)			
ISTP(5)[f] (continued)	5.4	Geologic system	Repository-induced geologic alterations	8.3.5.18 Higher-level findings	Issue resolution strategy for higher-level findings on qualifying and disqualifying conditions
	5.5	Future geology	Natural changes affecting future geology	8.3.5.18 Higher-level findings	Issue resolution strategy for higher-level findings on qualifying and disqualifying conditions
	5.6	Future geology	Future human-induced changes altering geology	8.3.5.18 Higher-level findings	Issue resolution strategy for higher-level findings on qualifying and disqualifying conditions
	5.7	Future geology	Future repository-induced alterations to geology	8.3.5.18 Higher-level findings	Issue resolution strategy for higher-level findings on qualifying and disqualifying conditions

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 26 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
		GEOLOGY: TECTONICS AND MINERALOGY (continued)			
PHPR	1.01.09	Physical processes	Physical processes in the unsaturated zone affecting repository behavior	1.8.2.1 Relation of geology to repository design	Contains information on the relation of geology to repository design
PHPR				8.3.1.2 Geohydrology	Includes processes occurring in the unsaturated zone
EA CRD	5.1	Ground-water chemistry	Unsaturated vs saturated zone chemistry	3.7.3, 3.9.1.3, 4.1.2 Ground-water geochemistry	Contains existing information on ground-water geochemistry
				8.3.1.3.1 Water chemistry	Development includes model of unsaturated and saturated zone water composition
EA CRD	4.2.2	Vadose water	Analysis of vadose water	8.3.1.2.2 Description of the unsaturated zone	Includes studies on hydrochemical characterization of the unsaturated zone

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 27 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
		GEOLOGY: TECTONICS AND MINERALOGY (continued)			
EA CRD	5.6	Dissolution	Equilibrium of mineralogy and aqueous chemistry	8.3.1.7 Dissolution	Studies to provide rates of rock dissolution
		Topopah Spring Member	Dissolution potential of Topopah Spring Member	4.1.2 Ground-water geochemistry	Provides existing material on ground-water chemistry
				8.3.1.7.1 Dissolution rates	Studies to provide rates of rock dissolution
EA CRD	5.1	Sorption	Sorption and varying water compositions	4.1.3.3. Sorption	Provides current information on sorption
				8.3.1.3.4.1 Geochemistry sorption	Includes studies of sorption as a function of ground-water composition
EA CRD	5.1	Particulates, colloids, complexes	Formation and transport of particulates, colloids, and complexes	4.1.2.7 Particulates and colloids	Provides existing information on particulates and colloids

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 28 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
			GEOLOGY: TECTONICS AND MINERALOGY (continued)		
EA CRD (continued)				4.1.3.5 to 4.1.3.6 Diffusion and radionuclide transport	Provides existing information on diffusion and transport
				8.3.1.3.4.1.4 Sorption on particulates and colloids	Activity to provide data on sorption on particulates and colloids
				8.3.1.3.5.2 Colloid behavior	Activity to provide data on colloid behavior
				8.3.1.3.6.1.5 Filtration	Activity to provide data on filtration
EA CRD	5.2	Actinide complexes	Effects of carbon-rich waters on actinide complexing	4.1 Geochemistry	Contains geochemistry background information
				8.3.1.3.5 Studies for radionuclide retardation	Contains studies and activities on carbonate waters and actinide speciation

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 29 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
		GEOLOGY: TECTONICS AND MINERALOGY (continued)			
EA CRD	4.1.1	Gaseous radionuclide	Gaseous transport of radionuclide	4.1.3.6 Radionuclide transport	Includes radionuclide transport by gas
				8.3.1.3.8.1 Retardation of gaseous radionuclides	Study to provide data on retardation of gaseous radionuclides
EA CRD	3.4.1.3	Geochemistry data base	Insufficient geochemistry data base	4.1 Geochemistry of the host rock and surrounding units	Provides background on site geochemistry
				8.3.1.3 Geochemistry	Includes studies to provide data on present and expected geochemical conditions
EA CRD	7.1.1	Geochemistry	Composition of percolating waters	8.3.1.2.2.8 Hydrochemistry of the unsaturated zone	Study to provide data on the composition of water in the unsaturated zone

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 30 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
		GEOLOGY: TECTONICS AND MINERALOGY (CONTINUED)			
NRC comment Draft EA	3	Geochemical environment	Oxidation-reduction conditions	8.3.1.3 Geochemistry	Includes studies to provide data on present and expected geochemical conditions
ISTP(3)[g]	3.1	Geochemistry	Present geochemistry	Chapter 4 Geochemistry	Current information on geochemistry
NRC comment Draft EA	8	Radionuclide transport	Radionuclide transport increases due to geohydrologic changes resulting from climatic alterations	3.7 Regional groundwater flow system	Provides existing information on recharge systems
				8.3.1.5.2 Climatic effects on hydrologic characteristics	Studies to provide information on the effects of future climatic conditions on hydrology
				8.3.1.3.7.1 Retardation sensitivity analysis	Activities providing information on radionuclide transport

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 31 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
		GEOLOGY:	TECTONICS AND MINERALOGY (CONTINUED)		
NRC comment Final EA	6	Matrix retardation	Can matrix retardation overcome increases in groundwater flow due to climate change?	4.1.3.5 Matrix diffusion	Current information on matrix diffusion
				8.3.1.3.7.1 Retardation sensitivity analysis	Activities providing information on radionuclide transport
NRC comment Draft EA	6	Retardation	Retardation of radionuclides	8.3.1.3.6.1 Dynamic transport column experiments	Activities to provide data on retardation of radionuclides
NRC Comment Final EA	8	Retardation	Value of matrix diffusion and colloid sorption on the retardation of radionuclides	8.3.1.3.6.2 Diffusion	Activities to provide data on diffusion
				8.3.1.3.4.1.4 Sorption on particulates and colloids	Activity to provide sorption data on particulates and colloids
ISTP(3)	3.3	Retardation	Future geochemistry affecting retardation	8.3.1.3 Geochemistry	Includes studies to provide data on expected geochemical conditions

Table 8.2-3. Correlation of site-related technical concerns and site characterization plan (SCP) sections where concerns are addressed (page 32 of 32)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
		GEOLOGY: TECTONICS AND MINERALOGY (CONTINUED)			
PHPR	1.05.02	Water courses	Chemical composition of water courses	4.1 Geochemistry of the host rock	Discusses mineralogy and retardation
				8.3.1.3.2 Mineralogy, petrology, chemistry of the host rock	Includes material along water courses
				8.3.1.3.4-8 Radionuclide retardation	Studies the chemical composition along flow paths

[a]EA CRD = Site specific comment response document for the environmental assessment for the Yucca Mountain site (DOE, 1986b).
[b]ISTP(1) = Draft Issue-Oriented State Technical Position (ISTP) for Nevada Nuclear Waste Storage Investigations (NNWSI) Project--Hydrology (NRC,1984).
[c]NRC comment = NRC Comments on the final environment assessment, Yucca Mountain site (Kale, 1986).
[d]NRC comment = NRC comments on the draft environmental assessment for the Yucca Mountain site (NRC, 1987).
[e]PHPR = These comments are taken from the Public Hearings Panel Report, NVO 263, dated November 1983 (DOE/NVO, 1983).
[f]ISTP(5) = Draft ISTP for NNWSI Project--Geology/Geophysics, (NRC, 1984).
[g]ISTP(3) = Draft ISTP for NNWSI Project--Geochemistry, (NRC, 1984).

Table 8.2-4. Correlation of engineered system related technical concerns and site characterization plan (SCP) sections where concerns are addressed (1 of 11)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
EA CRD[a]	4.1.1	Seismic effects	Potential effects of seismic activity on repository operation and performance	8.3.2.1.4 Repository modeling	Includes design considerations for seismic activity
EA CRD	5.4	Sealing program	Detailed description of sealing program	6.2.8 Shaft and borehole seals	Contains existing material on shaft and borehole seals
ISTP(4)[b]	4.6	Seal design	Will seal design meet 10 CFR 60.112	8.3.2.5.10 Construction of seals	States the results from other seals development tests
				8.3.3.1. Seal system	Contains planned seals design and modeling
EA CRD	5.11	Radionuclide releases to ground water	Predicted radionuclide releases to accessible environment at 100,000 yr	6.4. Design issues	Covers preliminary analysis of repository performance
				8.3.5.13.2 Post-closure system performance	Includes design concepts and calculational models for releases

Table 8.2-4. Correlation of engineered system related technical concerns and site characterization plan (SCP) sections where concerns are addressed (2 of 11)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
EA CRD	5.11	Waste package corrosion	Corrosion testing	7.4 Waste package design and geochemical interactions	Provides existing material on waste package design
PHPR[c]	1.02.12	Water chemistry	Water chemistry and effect on corrosion	8.3.4.2, 8.3.4.3 Waste package characterisitics	Includes activities to provide information on waste package and interactions with the environment
PHPR	1.02.14	Ground-water effects	Effects of ground water on repository components	8.3.4.2, 8.3.4.3 Waste package characteristics	Includes activities to provide information on waste package and interactions with the environment
				8.3.5.9-10 Assessment of containment within waste package	Contains waste package design information and containment assessment
NRC Comment Draft EA[d]	10	Waste package	Detailed materials plan	7.2-7.3 Waste package design basis, reference designs, and alternative designs	Contains information on waste package design and design basis

Table 8.2-4. Correlation of engineered system related technical concerns and site characterization plan (SCP) sections where concerns are addressed (3 of 11)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
ISTP(2)*	2.5	Waste package	Waste package releases within 10 CFR 20	8.3.4.3 Waste package	Issue resolution strategy for design of the waste package
ISTP(2)	2.6	Waste package	Waste package retrievability design	8.3.5.2 Waste retrievability	Contains design information and assessments relevant to retrievability
ISTP(2)	2.7	Waste package	Waste package design	8.3.5.9 Assessment of containment within waste package	Contains waste package design information and containment assessment
ISTP(2)	2.9	Waste package	Waste package monitoring	8.3.5.9 Assessment of containment within waste package	Contains waste package design information and containment assessment
PHPR	1.01.13	Resulting radiation doses	Potential for radiation releases to jeopardize individuals	8.3.5.13.5 Probabilistic radiation releases	Radionuclide releases from anticipated and unanticipated scenarios

Table 8.2-4. Correlation of engineered system related technical concerns and site characterization plan (SCP) sections where concerns are addressed (4 of 11)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
ISTP(4)	4.1	10 CFR 60.111	Repository design to maintain 10 CFR 60.111	8.3.5.14 Doses to individuals	Describes allowable doses
PHPR	1.03.13	Weapons testing	Safety factors provided against weapons testing or impact	6.1.2 Reference repository design	Contains current information on repository design
				8.3.1.13.2 Offsite installations	Provides offsite impact data to repository data base
PHPR	1.08.03	Weapons testing	Compatibility of weapons testing and waste disposal	8.3.1.13.2 Offsite installations	Provides offsite impact data to repository data base
PHPR	1.02.20	Flood protection	Identify flood protection measures for repository (surface)	8.3.2.5.8 Technology of surface facility construction	Design parameters include climate and flooding
PHPR	1.03.14	Nuclear criticality	Potential for waste to go critical	7.2.2 Waste forms	Describes considerations of waste form
				8.3.4.3.2 Waste form criteria	

Table 8.2-4. Correlation of engineered system related technical concerns and site characterization plan (SCP) sections where concerns are addressed (5 of 11)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
PHPR	1.03.19	Integrity of openings	Engineering methods used to maintain openings	6.1.1 Repository design requirements	Includes operation and decommissioning as design requirements
				8.3.2.5.9 Techniques for underground construction	Includes construction of safe openings
PHPR	1.03.20	Mining effects	Potential for continual mining affecting emplaced waste	6.4.10.2.2 Repository operations	Discusses expected repository operations
PHPR	1.03.23	Repository stability	Stability of repository maintained during coupled effects of excavation and thermal stress from emplaced waste	8.3.2.5.3 Repository operations plan	Includes considerations for operation during construction
ISTP(2)	2.8	Stability	Vicinity conditions affecting waste criticality	7.2.2 Waste forms	Describes considerations of waste forms

Table 8.2-4. Correlation of engineered system related technical concerns and site characterization plan (SCP) sections where concerns are addressed (6 of 11)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
ISTP (2) (continued)				8.3.4.3.2 Waste form criteria	Includes design information needed to comply with preclosure criteria for waste forms
PHPR	1.03.21	Weapons testing	Effects of weapons-induced seismicity on the repository	6.1.2 Reference repository design basis	Contains current information on repository design
				8.3.2.5.4 Repository design requirements	Includes requirements from 10 CFR 60 and 10 CFR 960
PHPR	1.03.25	Interaction effects	Results of long-term interaction between the barrier and host rock	8.3.5.13 Assessment of postclosure system performance	Includes models and scenarios of postclosure performance
PHPR	1.03.26	Waste package degradation	Degradation of waste package adversely altering the waste package environment	7.4.1 Waste package environment modification	Discusses interaction of waste package with emplacement environment

Table 8.2-4. Correlation of engineered system related technical concerns and site characterization plan (SCP) sections where concerns are addressed (7 of 11)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
ISTP(2)	2.2	Waste package	Ground-water penetration of waste package	8.3.4.2.4 Post-emplacement near field	Studies the changes in the near field
ISTP(3)[f]	3.2	Waste package environment	Changes in geochemistry due to waste package	8.3.2.1.2 Coupled-interaction tests	Studies include interactions between waste package and environment
PHPR	1.03.27	Backfilling	Complications due to backfilling	6.2.7 Backfilling	Discusses backfilling and techniques
ISTP(2)	2.1	Backfill	Ground-water penetration of backfill	8.3.2.2.7 Post-closure repository design	Studies to provide information necessary to develop the postclosure repository design
ISTP(4)	4.3	Backfill	Retardation ability of backfill	8.3.2.2.7 Post-closure repository design	Studies to provide information necessary to develop the postclosure repository design
ISTP(4)	4.4	Backfill	Does backfill compromise waste package?	8.3.2.2.7 Post-closure repository design	Studies to provide information necessary to develop the postclosure repository design

Table 8.2-4. Correlation of engineered system related technical concerns and site characterization plan (SCP) sections where concerns are addressed (8 of 11)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
ISTP(4)	4.5	Backfill	Does backfill control radiological releases?	8.3.2.2.7 Postclosure repository design	Studies to provide information necessary to develop the postclosure repository design
PHPR	2.04.02	Suitability	Suitability of Yucca Mountain resulting from factual evidence	8.3.5.18 Assessment of postclosure system and technical guidelines	Issue resolution strategy for higher-level findings on qualifying and disqualifying conditions
PHPR	3.01.03	Human engineering	Replacement of nonexistent favorable geologic conditions with engineered components	8.3.5.18 Assessment of postclosure system and technical guidelines	Issue resolution strategy for higher-level findings on qualifying and disqualifying conditions
PHPR	3.04.18	Existing technology	The use of existing international experience with waste disposal	Chapters 6,7 Conceptual design and waste package	Contain existing information and technology on repository and waste package design

Table 8.2-4. Correlation of engineered system related technical concerns and site characterization plan (SCP) sections where concerns are addressed (9 of 11)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
PHPR	3.04.18	Existing technology (continued)		8.3.2.1.3 Design optimization	Studies improving the design to better meet performance objectives
PHPR	3.03.03	Storage	Long-term storage experiments	8.3.4.1 Waste package program	Includes waste form testing
PHPR	1.03.17	Licensing requirements	Identify the licensing requirements for the repository and their limitations	8.1.1 to 8.1.2 Rationale for the site characterization program	Derivation of site characterization and issue resolution strategy
				8.2 Issues to be resolved through site characterization	Issues hierarchy
PHPR	1.01.10	Model uncertainties	Level of confidence of uncertainties in models	6.4.10.3 Future work	Planned work for model validation
				8.3.2.5 Adequate techniques	Assigns level of confidence

Table 8.2-4. Correlation of engineered system related technical concerns and site characterization plan (SCP) sections where concerns are addressed (10 of 11)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
PHPR	1.03.05	Waste package performance	Long-term performance characteristics of the waste package	7.4.2.3 Degradation modes of waste package materials	Provides information on corrosion and embrittlement phenomena
PHPR	1.03.06	Waste package performance	Waste package integrity under corrosive or thermal conditions	8.3.4.1.3 Waste package designs	Describes performance objectives of waste package
PHPR	1.03.22	Waste package design	Methods for waste stabilization	8.3.4.2.2 Reference waste package designs	Includes long-term corrosive and thermal properties
NRC comment Final EA[9]	9	Waste package performance	Uncertainties in performance models or parameters of waste package design	8.3.5.9 Waste package performance assessment	Includes discussion of uncertainty in waste package design and performance
ISTP(2)	2.3	Waste package releases	Radiological release rates from waste package	8.3.5.10 Assessment of waste package containment	Includes assessment of releases from waste package
ISTP(2)	2.4	Waste package releases	Radiological migration rates through failed waste package	8.3.5.10 Assessment of waste package containment	Includes assessment of releases from waste package

Table 8.2-4. Correlation of engineered system related technical concerns and site characterization plan (SCP) sections where concerns are addressed (11 of 11)

Source	Comment ID number	Major concern	Specific concern	SCP cross-reference	Content
ISTP(4)	4.2	Retrieval	Will underground facility allow retrieval	8.3.5.2 Issue resolution strategy for Issue 2.4; retrievability	Includes assessment of retrievability

[a]EA CRD = Site specific comment response document for the environmental assessment for the Yucca Mountain site (DOE, 1986b).

[b]ISTP(4) = Draft ISTP for Nevada Nuclear Waste Storage Investigations (NNWSI) Project--Geologic Repository Operations Area Design/Rock Mechanics, (NRC, 1984).

[c]PHPR = These comments are taken from the Public Hearings Panel Report, NVO 263, dated November 1983 (DOE/NVO, 1983).

[d]NRC Comment = NRC comments on the draft environmental assessment for the Yucca Mountain site (NRC, 1985a).

[e]ISTP(2) = Draft ISTP for NNWSI Project--Waste Package, (NRC, 1984).

[f]ISTP(3) = Draft ISTP for NNWSI Project--Geochemistry, (NRC, 1984).

[g]NRC Comment = NRC comments on the Final Environmental Assessment, Yucca Mountain site (Kale, 1986).

8.2.2 APPROACH TO ISSUE RESOLUTION

As explained in Sections 8.1.1 and 8.1.2, the performance and design issues were used as a convenient framework for structuring this document. Each of the sections in Sections 8.3.2 through 8.3.5 covering a performance or design issue contains an issue resolution strategy explaining the performance allocation developed for the issue and describing the site data needed to resolve the issue. The site data needs identified by the performance and design issues are also categorized into a series of specific site programs. Site characterization programs are presented in detail in Sections 8.3.1.2 through 8.3.1.17. Each program section is divided into a number of site investigations containing related studies and activities. Table 8.2-5 provides an overview of the arrangement of the performance and design issues and the site programs in Section 8.3. This table should allow a reader to more readily locate information of interest.

The overall approach the DOE has developed for issue resolution is described in Section 8.1.2. This approach leads to the identification of the information needed to resolve an issue, and to the development of plans for acquiring that information. The process of performance allocation was used to provide the rationale for conducting particular site characterization activities. The issue resolution process is intended to be iterative, in that information acquired during site characterization may cause revision to earlier plans and strategies. All changes to issue resolution strategies and site characterization plans will be reported in semiannual progress reports.

Throughout site characterization, a number of reports, currently called position papers, will be prepared, documenting the DOE's technical and regulatory positions. Position papers will be developed by assimilating data and information from published reports documenting the results of site program activities and analyses, performance assessment activities, and the design of the waste package and repository. The schedules presented in Sections 8.5.1 through 8.5.4, as well as the schedule sections of Section 8.3, include some reports that will serve as input to the position papers. Other documents, currently called issue resolution reports, will be prepared to document the implementation of the issue resolution strategies defined for performance and design issues in Sections 8.3.2 through 8.3.5. These reports may also be used to document positions on other technical issues of concern to the NRC, State, or public, such as an assessment of the seismic hazards at the Yucca Mountain site or the significance of calcite-silica deposits in faults near the site.

Throughout the issue resolution process, the DOE will be soliciting the views of and interacting with outside organizations, such as the NRC, on selected key topics. Additional information on issue resolution documentation can be found in Section 8.1.2.4. Potential topics to be covered in issue resolution reports are presented in Table 8.2-6.

The ultimate purpose of the issue resolution strategy is to provide the information necessary for issue closure. Issue closure will be possible when the level of confidence in the site processes and conditions, as well as in the engineered barriers relied upon to meet the regulatory requirements, has reached a level of reasonable assurance. After NRC staff and other technical reviews of the DOE's information supporting reasonable assurance, the DOE

Table 8.2-5. Overview of contents of Section 8.3 showing order of presentation of site programs and performance and design issues within major programs

Section 8.3.1 Site Program	Section 8.3.2 Repository Program	Section 8.3.3 Seal Program	Section 8.3.4 Waste Package Program	Section 8.3.5 Performance Assessment Program
8.3.1.2 Geohydrology 8.3.1.3 Geochemistry 8.3.1.4 Rock characteristics 8.3.1.5 Climate 8.3.1.6 Erosion 8.3.1.7 Rock dissolution 8.3.1.8 Postclosure tectonics 8.3.1.9 Human interference 8.3.1.10 Population density 8.3.1.11 Site ownership 8.3.1.12 Meteorology 8.3.1.13 Offsite installations 8.3.1.14 Surface characteristics 8.3.1.15 Thermal and mechanical rock properties 8.3.1.16 Preclosure hydrology 8.3.1.17 Preclosure tectonics	8.3.2.2 Configuration of underground facilities (postclosure), Issue 1.11 8.3.2.3 Repository design criteria for radiological safety, Issue 2.7 8.3.2.4 Nonradiological health and safety, Issue 4.2 8.3.2.5 Preclosure design and technical feasibility, Issue 4.4	8.3.3.2 Seal characteristics (postclosure), Issue 1.12	8.3.4.2 Waste package characteristics (postclosure) Issue 1.10 8.3.4.3 Waste package characteristics (preclosure), Issue 2,6 8.3.4.4 Waste package production technologies, Issue 4.3	8.3.5.2 Waste retrievability, Issue 2.4 8.3.5.3 Public radiological exposures--normal conditions, Issue 2.1 8.3.5.4 Worker radiological safety--normal conditions, Issue 2.2 8.3.5.5 Accidental Radiological releases, Issue 2.3 8.3.5.6 Higher level findings--preclosure radiological safety, Issue 2.5 8.3.5.7 Higher level findings--preclosure system and technical guidelines, Issue 4.1 8.3.5.9 Waste package containment, Issue 1.4 8.3.5.10 Engineered barrier system release rates, Issue 1.5 8.3.5.12 Ground-water travel time, Issue 1.6 8.3.5.13 Total system performance, Issue 1.1 8.3.5.14 Individual protection, Issue 1.2 8.3.5.15 Ground-water protection, Issue 1.3 8.3.5.16 Performance confirmation, Issue 1.7 8.3.5.17 NRC Siting Criteria, Issue 1.8 8.3.5.18 Higher level findings--postclosure system and technical guidelines, Issue 1.9

Table 8.2-6. Potential topics for issue resolution reports

Topic for issue resolution	Corresponding issue (SCP section)	Regulation
Requirement for protection of special sources of ground water	1.3 (8.3.5.15)	40 CFR 191.16
Design criteria for the shaft and borehole seals	1.12 (8.3.3.2)	10 CFR 60.134
General design criteria for the geologic repository operations area	2.7 (8.3.2.3)	10 CFR 60.131
Additional design criteria for surface facilities in the geologic repository operations area	2.7 (8.3.2.3)	10 CFR 60.132
Additional design criteria for the underground facility (preclosure)	2.7 (8.3.2.3)	10 CFR 60.133
Nonradiological health and safety requirements for repository workers	4.2 (8.3.2.4)	10 CFR 60.131
Final production technologies for fabrication, closure, and inspection of the waste package	4.3 (8.3.4.4)	10 CFR 60.135
Reasonable availability of technologies for repository construction, operation, closure, and decommissioning	4.4 (8.3.4.4)	10 CFR 60.135
Radiation exposure, radiation levels, and releases of radioactive material to the repository workers and the public under accidental conditions	2.3 (8.3.5.5)	10 CFR 960.5-1 10 CFR 60.2 10 CFR 60.131-133 10 CFR 72.68 10 CFR 50, Appendix A
Design criteria for the waste package and its components	2.6 (8.3.4.3)	10 CFR 60.135
Additional design criteria for the underground facility (postclosure)	1.11 (8.3.2.2)	10 CFR 60.133

Table 8.2-6. Potential topics for issue resolution reports (continued)

Topic for issue resolution	Corresponding issue (SCP section)	Regulation
Requirement for limiting individual doses in the accessible environment	1.2 (8.3.5.14)	40 CFR 191.15
The performance objective for protection against radiation exposures and releases of radioactive materials	2.1 (8.3.5.3) 2.2 (8.3.5.4) 2.3 (8.3.5.5) 2.7 (8.3.2.3)	10 CFR 60.111 10 CFR 60.131 10 CFR 60.132 10 CFR 60.133
Radiation exposures, radiation levels, and releases of radioactive material to the public under normal conditions	2.1 (8.3.5.3)	10 CFR 60.111 10 CFR Part 20 40 CFR 191, Subpart A
Radiation exposures, radiation levels, and releases of radioactive material to repository workers under normal conditions	2.2 (8.3.5.4)	10 CFR 960.5-1 10 CFR Part 20
The performance objective for preserving the option of waste retrievability	2.4 (8.3.5.2)	10 CFR 60.111(b)
Evaluation of the Yucca Mountain site against NRC Siting Criteria	1.8 (8.3.5.17)	10 CFR 60.122
The design criteria for the waste package considering its interactions with the emplacement environment	1.10 (8.3.4.2)	10 CFR 60.135
The performance objective for substantially complete containment by the waste package	1.4 (8.3.5.9)	10 CFR 60.113
The performance objective for controlled radionuclide release by the engineered barrier system	1.5 (8.3.5.10)	10 CFR 60.113
The performance objective for pre-waste-emplacement groundwater travel time	1.6 (8.3.5.12)	10 CFR 60.113

Table 8.2-6. Potential topics for issue resolution reports (continued)

Topic for issue resolution	Corresponding issue (SCP section)	Regulation
The performance objective for overall system performance	1.1 (8.3.5.13)	10 CFR 60.112
The prediction of cumulative radionuclide releases over 100,000 years	1.9 (8.3.5.18)	10 CFR 960.3
The requirements for performance confirmation	1.7 (8.3.5.16)	10 CFR 60.137
Evaluation of potential hazards at the Yucca Mountain site resulting from underground nuclear explosions at the Nevada Test Site	NA[a]	NA[a]
Mode of origin of calcite-silica deposits and the potential effects on repository performance	NA	NA
Assessment of volcanic hazards at the site	NA	NA
Assessment of potential hazards at the site due to faulting and vibratory ground motion	NA	NA
Evaluation of potential impacts at the site due to natural resource extraction	NA	NA
Potential for coupling of tectonic and hydrologic processes and events	NA	NA

[a]NA = not applicable.

would then determine either that the level of uncertainty is too large, and propose to acquire additional information to reduce the uncertainty, or alternatively, the DOE may decide to move forward with the proposed position.

8.2.3 ISSUE TRACKING

As described in Section 8.2.1, the performance and design issues were derived from NRC and DOE requirements. The information needs that have been identified under each issue represent the site data and other technical information to be used to support the resolution of the issue. The site programs described Section 8.3.1 were structured to acquire the data on present and expected site characteristics, processes, and events needed to develop site descriptions and to support the resolution of the performance and design issues. The general plan for issue tracking and resolution is depicted schematically in Figure 8.2-6. Site information, obtained from tests in the exploratory shaft facility and from surface-based site studies, will be used as required to design a suitable waste package and the surface and underground repository facilities. On the basis of the engineered system designs and the site characteristics and conditions, performance assessment calculations will be made to predict preclosure performance for normal and accident conditions, and to predict postclosure performance under both nominal (undisturbed) and disturbed conditions. The DOE will use these predictions as a part of the basis for selecting a repository site according to the process described in 10 CFR Part 960. The repository designs and the performance assessment predictions will also serve as the basis for determinations of compliance with the NRC requirements for permanent disposal of high-level radioactive waste as specified in 10 CFR Part 60.

As shown in Figure 8.2-6, site investigation reports will document the completion of various site activities. These reports will continue to update and extend the data base available for use in repository design and performance assessment activities. When designs and calculations are sufficiently mature, a variety of topical reports, and finally, issue resolution reports will document the preliminary basis upon which the DOE will seek NRC's concurrence with various regulatory and technical requirements. Thus, by acquiring the site data and other information necessary to support resolution of the performance and design issues, the DOE will systematically establish the information necessary to support demonstrations of compliance with the major technical and regulatory requirements.

An integrated system for monitoring and tracking progress toward issue resolution is under development. The technical basis derived from Section 8.3 provides the list of site activities planned to develop the data base for use in repository and waste package design and performance assessment calculations. Study plans for the site activities will describe the tests and experiments in more detail. Descriptions of repository and waste package design activities that do not require site data will be provided in other documents. These activities will also be monitored through the issue resolution tracking system. As site information and results of design analyses and activities becomes available, the baseline information will be updated. This process will continue until final designs have been developed and credible performance assessment predictions have been prepared

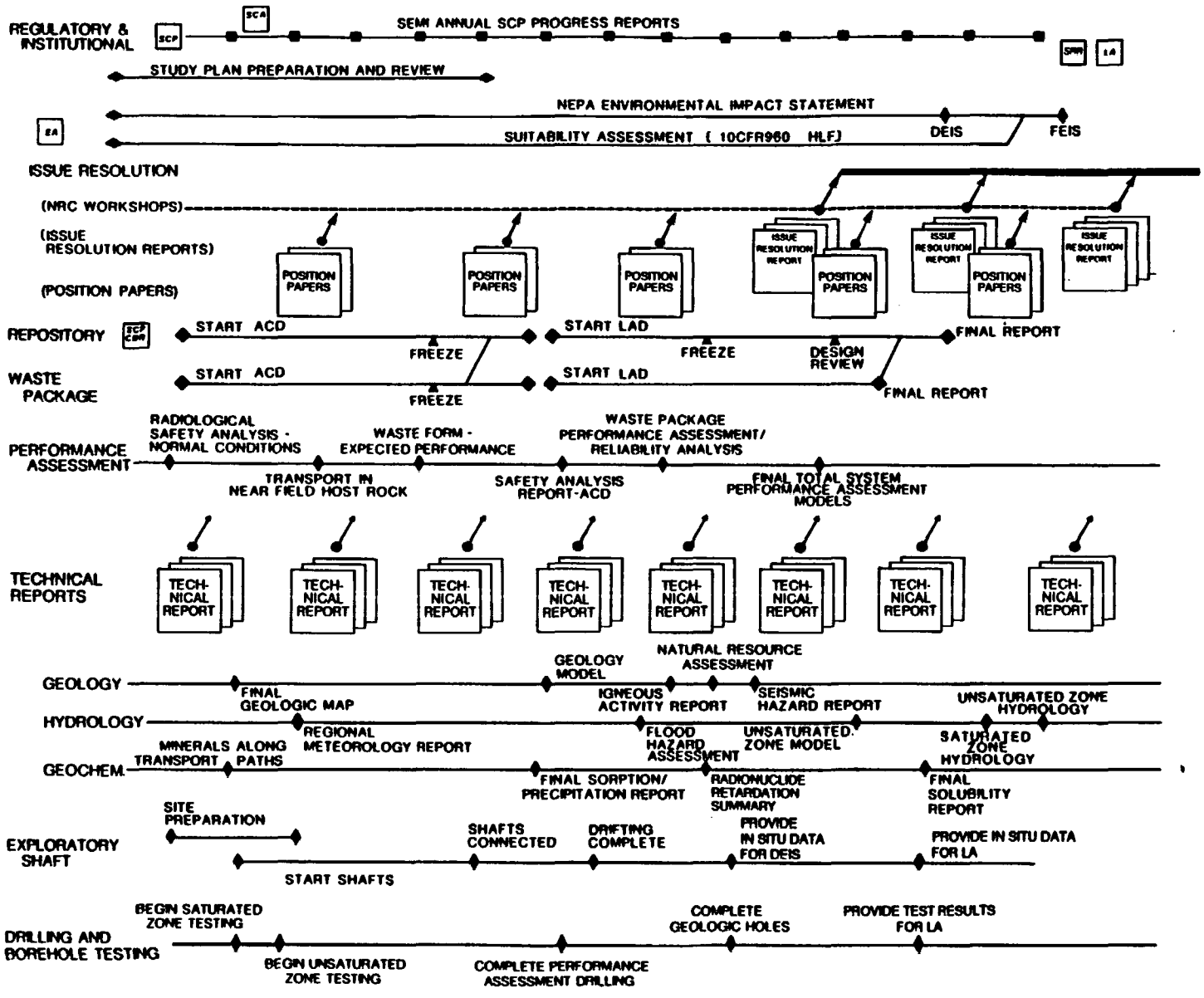

Figure 8.2-6. Schematic diagram showing utilization of site data by performance assessment and design, and for preparation of regulatory documents. (ACD - advanced conceptual design; DEIS - draft environmental impact statement; FEIS - final EIS; HLF - higher-level findings; LA - license application; LAD - LA design; NEPA - National Environmental Policy Act; SCA - site characterization analysis; SCP - site characterization plan; SRR - site recommendation report)

on the basis of those designs. Resolution of those issues that address the DOE's siting guidelines (10 CFR Part 960) will occur when the DOE determines that the requirements of these guidelines have been met in support of the site-selection process. Resolution of those issues that address the NRC's requirements for repository performance and issuance of construction authorization cannot occur until the NRC determines that there is reasonable assurance, at that time, that all requirements are likely to be met.