OGR/B-6
Control No. _____

ATTACHMENT B

Annotated Outline for the SCP Conceptual Design Report

May 1985

U.S. Department of Energy
Office of Civilian Radioactive Waste Management

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FOREWORD

The Nuclear Waste Policy Act of 1982 (NWPA) requires that site characterization plans (SCPs) be submitted to the Nuclear Regulatory Commission (NRC), affected States and Indian tribes, and the general public for review and comment prior to the sinking of shafts at a candidate repository site. The SCP is also required by the NRC licensing procedures for the disposal of high-level waste contained in 10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories."

An Annotated Outline (AO) for Site Characterization Plans (OGR/B-5) has been prepared to provide DOE's standard format and guidance for preparation of SCPs. Consistent with the AO for SCPs, Chapter 6 of the SCP is to provide the requirements and reference the media-specific design data base, describe the current design concepts, and discuss design information needs. DOE intends for the Chapter 6 information to meet the requirements of the NWPA (Section 113(b)(1)(C)) and 10 CFR 60.

In order to develop this design information, the Office of Geologic Repositories program is planning a SCP conceptual design phase as part of the overall repository design process. This phase is the first step in the design process, and the result design can be expected to change as the program moves through the site characterization phase.

The Annotated Outline which follows provides the standard format and guidance for the preparation of the SCP Conceptual Design Reports. It has been developed primarily for use of the DOE and its contractors to assure consistent scope and level of detail of the SCP Conceptual Design, and assure a common format among the projects for the SCP Conceptual Design Report. It is considered to meet the intent of NRC's proposed Generic Technical Position on Design Information Needs in the SCP (dated February 1985) and the philosophy contained therein.

The SCP Conceptual Design Report will be the primary basis for preparation of Chapter 6 of the SCP and will be a stand-alone reference document for the SCP. Appendix 1 to this Annotated Outline provides a correlation between Chapter 6 of the SCP and the SCP Conceptual Design Report for information purposes.

EXECUTIVE SUMMARY
(5 to 10 pages)

The executive summary will provide a management-level view of the report, summarizing its most significant parts. It will address both the conduct and the results of the SCP conceptual design. The summary will be presented in narrative form with references to the other sections of the report for additional detail as appropriate. Its objective will be to provide the reader with a quick but comprehensive understanding of the work that was accomplished and reported in the remainder of the report.

Chapter 1

INTRODUCTION
(5 to 10 pages)

This chapter will present background information on the project and past design efforts, explain the DOE's decision to redefine the repository design phases, and provide general information relevant to the SCP conceptual design. The general information to be provided will include the scope of the design; a summary of the laws, regulations, and DOE orders that the design complies with; the organization of the report; and the intended use for the report.

Chapter 2

BASES FOR THE SCP CONCEPTUAL DESIGN
(29 to 62 pages)

The purpose of this chapter will be the documentation of those reference values and design assumptions used by the architect engineer in the completion of the SCP conceptual design.

This chapter will also discuss the technical requirements and assumptions that are the bases for the repository design; the site constraints, assumptions and data that affect the design or the approach to the design, and the reference geologic and geotechnical data used in the design. This chapter will not discuss the role of any of these features or elements in providing waste isolation capability. Such discussion will occur in appropriate chapters of the SCP.

2.1 WASTE FORM AND PACKAGE
(1 to 2 pages of text)

The narrative will provide a summary description of (1) each waste type received at the repository, (2) each waste-container design, and (3) current waste-package designs.

A data sheet will be presented for each waste-package type, waste form, etc., and will include a sketch, reference dimensions, materials, and radiation levels. Reference sources of waste-package design information will be included.

2.2 SITE
(10 to 15 pages of text; 4 to 5 figures)

The narrative will summarize the site conditions that were used in performing the SCP conceptual design. To the extent possible, this information will be a summary of the information presented in Chapters 1 and 3 of the SCP. The specific features to be discussed include the following:

- Geology--the known geologic features affecting repository design.
- Hydrology--the known or assumed hydrologic conditions at the site, including the peak (worst case) design conditions established from these data. Cross sections will be used to show aquifer locations with respect to the repository horizon.
- Stratigraphy--the known or assumed stratigraphic framework, including a stratigraphic map showing the major rock units.
- Terrain--the known or assumed geomorphic units at the site will be described and shown on a topographic map.
- Soils--the known or assumed soil conditions and near-surface rock characteristics used in the SCP conceptual design of repository building foundations will be described and shown on a surface stratigraphic map.

- Flood zones--The 50-year, 100-year, 500-year, and maximum credible flood zones at the repository site will be discussed and shown on topographic maps.

- Archaeological resources--any construction areas known to have archaeological significance will be discussed and identified on a map (if available).

2.3 DATA AND ASSUMPTIONS
(15 to 20 pages of text; 7 to 12 tables)

This section will summarize the source design values of the SCP conceptual design. These values may be measured site-specific values, handbook values, or data derived from the literature. Data sources will be referenced and assumptions identified. The relationship between nominal and design values will be discussed. The specific site data to be described and tabulated will include--

- Rock properties--(as appropriate for the specific host rock), compressive strength, shear strength, cohesion, angle of internal friction, Young's modulus, bulk modulus, thermal conductivity, specific heat, density, porosity, and fracture frequency and direction.

- Climate and weather--design-basis normal and severe values of temperature, winter and summer insulation, precipitation, wind roses (four seasons), and maximum wind speeds (data from SCP Chapter 5).

- Natural phenomena--the full range of natural phenomena expected at the repository site, with worst-case design values identified for safety-related and for non-safety-related systems (data from SCP Chapters 1 and 5).

- Human induced phenomenon--the full range of phenomenon expected at the site as a result of human activity (e.g., weapons testing) with worst case design values identified for safety and for nonsafety-related systems, structures and components.

2.4 DESIGN REQUIREMENTS
(7 to 10 pages of text)

This section will summarize the project-specific design requirements used in the SCP conceptual design, identifying design requirements known to have become obsolete during the design and describing the revisions. It will address major repository requirements, including (1) broad general design requirements; (2) definition of repository scope (throughput, waste type); (3) the regulations, codes, and standards governing the repository design; and (4) the principal DOE programmatic and functional repository requirements (i.e., Generic Requirements Document, Mission Plan).

2.5 RADIATION PROTECTION
(2 to 5 pages of text)

This section will summarize the radioactivity and criticality parameters used in repository design (i.e., maximum fissile content, fissile source data, worst-case radionuclide concentrations and composition).

2.6 REGULATORY REQUIREMENTS
(2 to 5 pages of text)

This section will identify the currently known Federal, State, and local regulations that cover repository design and construction. The design criteria developed from these laws, regulations, and codes will be referenced in project-specific bases for design.

2.7 CLASSIFICATION OF SYSTEMS, STRUCTURES, AND COMPONENTS
(2 to 5 pages of text; 1 to 2 tables)

This section will summarize the DOE's method of classifying repository systems, structures, components, and excavations according to their importance to safety and waste isolation. It will define the different classes, describe and reference the procedures used, and summarize the QA elements of the procedure.

Chapter 3

REPOSITORY
(23 to 38 pages)

This chapter will provide a complete overview of the principal operations or functions that will be performed in the repository: waste handling and emplacement, waste retrieval, mining, and ventilation. To the extent necessary for clarity, it will describe the systems and equipment needed to perform these functions. Known equipment and concepts requiring development will be identified.

3.1 WASTE HANDLING AND DISPOSAL
(8 to 12 pages of text; 2 to 4 flow diagrams)

The narrative will describe the current concepts envisioned for the receipt, handling, mechanical processing, packaging, storage, movement, and emplacement of wastes at the repository. This information will be presented for each type of waste to be received at the repository. In addition, this section will contain the following:

- Block flow diagrams defining the functions of the principal steps involved in the receipt, processing, packaging, and disposal of wastes.
- Conceptual flow diagrams showing the equipment used in the receipt, processing, packaging, storage, and disposal of waste.
- Lists of the major equipment identified in the flow diagrams, with emphasis on the equipment needing development.

3.2 WASTE RETRIEVAL
(4 to 6 pages of text; 1 to 2 flow diagrams)

The narrative will discuss the DOE's philosophy on, and approach toward, waste retrievability and will describe current concepts for the retrieval of wastes emplaced in the repository, transport to the surface facilities, and shipment off the site. Flow sheets will be consistent with the DOE position on waste retrievability (as stated in DOE's Generic Requirements for a Mined Geologic Disposal System, Appendix D). The principal steps involved in retrieval will be shown in a block flow diagram. Equipment needing development will be identified.

3.3 UNDERGROUND DEVELOPMENT
(6 to 10 pages of text; 2 to 3 flow diagrams)

The narrative will describe the concepts for the development of the underground operations area simultaneously with waste emplacement. Included in the discussion will be the following:

- The mining method(s) selected for the principal repository areas.
- Mining sequence, from the initiation of shaft or ramp construction to full underground development.
- Impacts of MSHA regulations on repository development.

- The mined-rock handling, transportation, and disposal systems required to support underground development.

- The ground-support methods and approach that will be used in underground development.

- Equipment needing development.

Mechanical flow diagrams will be used to support the narrative. Where appropriate, these diagrams will identify the principal pieces of equipment and their functional requirements.

3.4 VENTILATION

(5 to 10 pages of text; 4 to 6 flow diagrams)

This section will describe the underground ventilation systems that are currently envisioned--one for the underground development and the other for waste emplacement. The narrative for each system will describe the complete ventilation system, from the surface through the intake shafts; the underground operation; and the exhaust shafts, fans, filters, and stack. It will also discuss the operating conditions (pressure, volume, ambient conditions, etc.), and system pressure interactions to the extent known, and will identify equipment needing development.

The narrative will be supported by illustrations, including air-flow logic diagrams that indicate operating conditions (pressure, air flow) at strategic locations and principal equipment.

Chapter 4

DESIGN DESCRIPTION
(33 to 60 pages)

This chapter will describe and discuss the conceptual design of the repository, with emphasis on the excavations, facilities, systems, and equipment needed to perform the operations described in Chapter 3.

4.1 THE SITE AND ITS ENVIRONS
(2 to 3 pages of text; regional map)

The narrative in this section will describe the important features of the area in which the repository site is located, including the terrain, climate, major bodies of water, population centers, economic activities in nearby areas, existing railroads and highways, regional power-transmission facilities, and water sources. A regional map will show the repository site (without detail), access roads and railroads, regional roads and railroads, water bodies, major structures and facilities not related to the repository, and utility lines from the site boundary to the point of connection with the source.

4.2 SURFACE FACILITIES
(5 to 10 pages of text; 10 to 15 drawings)

The narrative description will begin with the repository layout and a general discussion of the factors that were considered in arriving at the layout. As a minimum, the following factors should be addressed:

- Surface terrain and natural site features
- Foundation features
- Site-specific normal and severe natural phenomena, (e.g., flood protection
- Shaft locations
- Integration of the exploratory-shaft facility into the repository
- Site security
- Visual aesthetics
- Future site expansion
- Area and regional environmental impacts (air quality, water quality)
- Storage and disposal of mined rock
- Offsite utility supply
- Offsite rail and road access

As a minimum, the following facilities should be identified:

- Waste-handling building (Phase I)
- Waste-handling building (Phase II)
- Health and medical facilities
- Fire protection facilities
- Security facilities
- Maintenance facilities
- Administration and personnel facilities
- Laboratory and testing facilities
- Warehousing and receiving facilities
- Visitors center
- Backup power generation facility
- Explosives magazines
- Cooling tower and chilled-water facility
- Backfill storage

- Potable water facility
- Sewage facility
- Backfill facility
- Packing facility
- Exhaust-shaft filtration facility

The functions of each facility will be addressed very briefly with the exception of the waste-handling buildings. The discussion of the waste-handling buildings should include the facilities for both Phase I and Phase II; the modification of Phase I facilities for use in Phase II; and the purpose of the general functional areas, such as receiving area, processing areas, and administrative areas. No details will be provided for the waste handling equipment, consolidation equipment, packaging or other process equipment. The process flow diagrams presented in Chapter 3 will not be expanded in this section.

A site arrangement drawing will be provided to show (1) all the facilities addressed by the narrative, (2) the location of the shafts and ramps, (3) the location of the major utilities from the point where they enter the site to the point of onsite distribution, (4) the perimeter fence, and (5) the location of onsite roads and rail lines. Only the outlines of the onsite facilities will be shown. No engineering details will be given for any of the surface facilities except for the waste-handling building, in which case the engineering detail should not exceed that required to support the development of (1) a general arrangement drawing that roughly sizes and blocks out functional areas and (2) schematic drawings of the waste-handling and waste-processing facilities. To the extent possible, the processing technology should be technology that has been developed to at least the conceptual level of design, such as the MRS consolidation facility design, to provide a basis for the design presented.

4.3 SHAFTS AND RAMPS

(5 to 10 pages of text; 5 to 10 drawings)

The narrative description of the shafts and ramps will include (1) the function and the size of each shaft or ramp; (2) the shaft liners, including the operating seals (for ramps, the method of support or lining); (3) the construction method and general construction sequence planned for each shaft or ramp, including each component of the shaft operating seals and the design provisions made to ensure that site integrity is not impacted by the shaft operating seals; and (4) the air-flow quantity and direction in each shaft or ramp and the part of the ventilation system it will support.

Cross sections of all the shafts and ramps will depict the dimensions of the opening, liners and liner seals or rock support for ramps, and an outline of any conveyance to be used. Also included will be, if appropriate, a vertical section of a typical shaft that shows seal rings and their relationship to major stratigraphic features.

For each shaft that contains a hoist, the narrative will describe the hoisting system and its functional requirements, the type and general arrangement of the headframe and the hoist, and preliminary estimates of hoisting capacities.

Drawings showing the general configuration of the hoist, headframe, and conveyance will be included, but no details of these features will be provided.

4.4 UNDERGROUND FACILITIES
(10 to 20 pages of text; 10 to 20 drawings)

Supported by general underground layout drawings, the narrative will define the design concepts for the underground facilities. It will explain the relationship of the exploratory shaft (ES) facilities to the repository layout and how the ES facilities will be used both during the development of the repository and during each stage of repository operation. The description of the layout will include the shaft stations, maintenance areas, storage areas, muck-handling facilities, administrative and support areas, main access ways, ventilation return drifts, cross cuts, drainage system, emplacement rooms, waste-emplacement openings, and the required utilities.

Included in the narrative should be (1) the design rationale for the underground layout; (2) the design of openings, including the parameters considered in developing the design; (3) the rock-support systems to be used; and (4) the sequence of development for the various phases of the project. If major alternative concepts are being considered, they will be discussed to the level of detail provided for the primary concept.

The underground-layout drawings will include the following:

- General arrangement drawings depicting the operational arrangement for each phase of development
- Shaft-pillar arrangement
- Typical cross sections for all types of openings in the underground facility
- Drainage-system drawing showing the direction of flow and the location of collection and pumping facilities
- Drawings of the muck-handling area, including skip-loading arrangement
- Isometric of the waste package in an emplacement hole within a typical emplacement room

4.5 NORMAL REPOSITORY OPERATIONS
(10 to 15 pages of text; 4 to 8 drawings)

The narrative will describe the operations that will be required to receive and emplace a waste package underground. It will address the development sequence of the waste-emplacement rooms (based on waste receipts), the preparation of the emplacement holes, packing installation (site-specific), transfer operations at the shaft station, transport to the emplacement hole, and emplacement-hole closure. A description of waste retrieval operations under normal conditions will also be provided to the level of detail provided for emplacement.

The drawings to be provided for waste emplacement and retrieval will include a schematic diagram of the steps involved in these operations; an isometric drawing of the waste transporter; and a drawing of the waste-emplacement rooms that shows the location, spacing, and size of emplacement holes.

For mining, the narrative will identify and describe the proposed mining techniques, including the major equipment needed for each technique, the expected rate of advance, maintenance requirements, and the flexibility of the mining method. Also discussed will be muck handling from the face of the rock to the muck-handling facility, with a listing of equipment requirements. Schematic drawings of the mining and muck-handling operations will be included.

Other construction activities to be addressed in this section will include the installation of utilities and ventilation structures and equipment. The utilities outside the shaft pillar will be addressed only to the extent of identifying the utilities, both temporary and permanent, that will be provided in various areas of the facility.

For the ventilation and cooling design, the narrative will include (1) the functions; (2) the design philosophy, explaining how the mine-development air system is separated from the emplacement ventilation system; (3) the differential pressure that will exist between the two systems at various strategic locations underground; (4) air temperatures at all underground locations; (5) both temporary and permanent stopping, as well as their use; and (6) methods of changing a room from the mining ventilation system to the emplacement ventilation system.

4.6 SYSTEMS, STRUCTURES AND COMPONENTS IMPORTANT TO SAFETY
(1 to 2 pages of text; 2 to 4 tables)

This section will present a preliminary listing of the repository systems, structures, and components that were identified as important to safety.

Chapter 5

CLOSURE AND DECOMMISSIONING
(17 to 33 pages)

This chapter will describe the closure and decommissioning of the repository, including the closure of the underground facilities, the sealing of shafts or ramps, the sealing of boreholes, and the decommissioning of surface facilities.

5.1 CLOSURE OF UNDERGROUND FACILITIES
(5 to 10 pages of text; 6 illustrations)

The narrative will describe the closure of the underground access drifts, waste-emplacement rooms, other underground areas, and the exploratory-shaft facility, including the removal of operating equipment and the installation of engineered barriers in the form of strategically located bulkheads and the emplacement of backfill if required.

The removal of operating equipment will be summarized in a brief narrative supported with tabulations if necessary. The discussion of backfill will include a brief description of the concept and the underlying rationale; the function, material, and any known major equipment for backfill processing and emplacement; the expected relationships between the chemical and mechanical properties of the materials and the repository environment; and the expected effects of radiation and thermal-structural loading on the backfill. The narrative will be supported with several illustrations.

This description of current concepts for engineered barriers other than the backfill (e.g., strategically located bulkheads) will include the function, rationale, and material makeup and emplacement method. Engineered barriers in the form of liners that may be used for underground openings will be discussed in Section 5.2.

5.2 SEALING OF SHAFTS AND RAMPS
(5 to 10 pages of text; 4 illustrations)

The narrative will describe the current design concepts for the postclosure sealing of the shafts or ramps. This description will address only the liners that are to be installed during closure; preclosure liners are to be discussed in Chapter 4.

The discussion of shaft sealing will include (1) the shaft-sinking method(s) and any treatment of the rock for stability and ground-water control necessary for repository construction and operation, (2) the dimensions of key features, (3) the types of seal materials, (4) the properties of the seal materials, and (4) the properties of the rock and ground water that are relevant to shaft lining or seal design. The discussion should include an analysis of postclosure seismic effects on long-term seals. If such information is not available, this section will identify the necessary information. The narrative will be supported with four illustrations.

5.3 SEALING OF BOREHOLES
(5 to 9 pages of text; 1 to 2 tables)

The narrative will discuss the primary functions for borehole seals both above and below the water table and describe the conceptual designs of these

seals for waste isolation and aquifer isolation. Included in the discussion will be the following:

- The approximate number, size, and location of the boreholes requiring sealing
- Components of borehole seals for each borehole requiring a different treatment
- For each type of seal, the key features, seal materials, and the relevant properties of the surrounding rock and ground water
- Potential effects of postclosure seismic activity on seals

The discussion will consider borehole casings and other materials placed in the borehole. It will identify the information required for a more definitive design. The narrative will be supported with illustrations and tables showing the seals and their material components.

5.4 DECOMMISSIONING OF SURFACE FACILITIES
(2 to 4 pages of text)

The narrative will explain the current decommissioning concepts, identify the major facilities requiring the consideration of decommissioning in design, and describe the surface facilities requiring decontamination. Where designs are not available, it will identify the method that will be used to establish decommissioning concepts and design considerations.

Chapter 6

PERFORMANCE OBJECTIVES
(47 to 77 pages)

This chapter will discuss the repository design features and operating procedures that will be used to ensure compliance with the NRC limits for preclosure (i.e., operational) releases, NRC objectives for waste retrieval, and NRC objectives for long-term waste isolation.

6.1 RADIOACTIVE RELEASES DURING NORMAL OPERATIONS
(15 to 25 pages of text; 3 conceptual flow diagrams)

This section will describe the facilities and operations used to prevent or to limit radiation exposures and releases of radioactive materials to unrestricted areas.

6.1.1 Liquid Effluents

The narrative will discuss the design concepts and approaches for the collection, monitoring, treatment, and disposal of on-site-generated liquid radwastes. It will identify the sources of liquid waste and estimate the composition and volume of the waste. The narrative will be supported with a conceptual flow diagram.

6.1.2 Solid Waste

The narrative will describe the design concepts and approaches for the collection, monitoring, treatment, and disposal of on-site-generated solid radwaste. A conceptual process flow diagram will show the principal waste sources, estimated volumes, principal treatment steps, and proposed disposal method.

6.1.3 Gaseous Waste

The narrative will discuss the design concepts for the handling of gaseous waste, including hot-cell exhausts, ventilation exhausts from the waste-handling building, and exhaust from the underground emplacement areas. The discussion will cover the ventilation approaches and concepts that will be used to protect the working environment. The narrative will be supported by air-flow logic diagrams, conceptual process flow diagrams for treatment systems, and plan-view drawings showing negative pressure zones.

6.1.4 Site Monitoring

This section will discuss the requirements for site monitoring during repository operations and describe the design philosophy of the monitoring program (type of monitors, functional requirements, etc.).

6.2 RELEASES UNDER ABNORMAL CONDITIONS
(4 to 6 pages of text; 2 tables)

The current status of design does not allow the full systematic identification of systems, structures, and components important to safety. This report will make tentative identifications based solely on engineering judgment. As the systematic evaluation proceeds, this initial list will be changed.

6.2.1 Design-Basis Accidents

The narrative will discuss the methods used to identify and develop the design-basis accidents and identify any that have been developed to date. It will also discuss the methods that will be used to quantify offsite releases and estimate the releases, if possible, referring the reader to Section 7.4, "Systems, Structures, and Components Important to Safety and Waste Isolation," for details of the analytical techniques, codes, etc. A table of identified accidents and estimated releases will be included.

6.2.2 Design of Mitigating Features

The narrative will describe the design of the features that will mitigate any offsite releases due to the postulated accidents. Where the design has not been completed, the discussion will focus on the guiding philosophy and the criteria to be used for design development. The narrative will be supported by a tabulation of mitigation features and the degree of mitigation expected, if available.

6.3 WASTE RETRIEVAL

(9 to 18 pages of text; 3 to 4 illustrations)

This section will describe the repository design concepts that will preserve the waste-retrieval option and the demonstration program required to show compliance with NRC objectives.

6.3.1 Expected Conditions

The narrative will discuss the predicted repository environment (rock temperature, rock conditions, air temperature, backfill condition if used, etc.) as a function of time for the waste-retrievability period. Worst-case extremes will be identified and discussed. The parameters of interest will also be displayed in graphical form.

This discussion will also include a review of items or events which can reasonably be expected to occur during repository operations. These items could include malfunction of retrieval mechanisms, breached or stuck canister, repair of access ground support, salt creep and corresponding canister movements, ventilation system failure, etc.

6.3.2 Retrieval Demonstrations

This section will present preliminary plans for the demonstration of retrieval concepts, including equipment requiring development. Retrieval of quantities of waste larger than demonstration quantities (i.e., partial retrieval) will be discussed. This section should also contain a discussion of how the expected adverse conditions discussed in Section 6.3.1 will be accommodated by the planned equipment and operating procedures. For the specific case of salt creep and potential canister movement, address what measures will be used to ensure the ability to locate canisters.

6.3.3 Full Repository Retrieval

The discussion of the design approach to full repository retrieval will include the following:

- The extent to which full retrieval is designed into the repository.
- The design criteria and concepts incorporated to ensure maintenance of retrieval capability.
- Principal underground problems expected.
- R&D programs and needs.
- Identified constraints on repository design.
- Expected worst-case conditions and scenarios for retrieval.

6.4 WASTE ISOLATION
(10 to 14 pages of text; 3 illustrations)

This section will discuss the design and operational measures taken to reduce adverse effects on the waste-isolation system.

6.4.1 Opening Stability (10 CFR 60.133(e))

The narrative will discuss the design of underground openings, including ground support system, identifying features that provide long-term stability at elevated temperatures. It will consider the effects of in-situ stress. The supporting diagram will show the shape of underground openings versus the maximum stress around the opening.

6.4.2 Underground Layout

The narrative will discuss the sequence of underground development and waste emplacement, including the relation of underground development to such features of the site as faults and geologic structures and including the effects of in-situ stress and fracture direction. It will be supported by two drawings showing the underground layout with respect to the in-situ stress direction, fracture direction, and the extraction ratio.

6.4.3 Rock Excavation (10 CFR 60.133(f))

This section will discuss the selected rock-excavation methods and the alternatives that have been considered. The discussion will cover evaluations of potential damage to the host rock, including, as a minimum, the nature and extent of the damage zone around the opening, the potential for fracture healing (if applicable), and the potential for connection to aquifers or to adverse tectonic structures.

6.4.4 Thermal Loads (10 CFR 60.133(i))

This section will discuss the design concepts and approaches planned to establish the acceptable thermal loading, including the temperature and stress relationship in the host rock resulting from the areal heat loading.

6.4.5 Shaft and Borehole Seals (10 CFR 60.134)

This section will describe how the seals for the shafts and boreholes will be designed to prevent, to the maximum extent practicable, shafts and boreholes from becoming preferential pathways to the accessible environment. It will consider the extent and nature of damage zones around openings, the sealing of aquifers, the pretreatment of rock surfaces before seal emplacement, the selection of seal materials, the reworking of drill holes, the removal of casings, etc.

6.5 PERFORMANCE CONFIRMATION
(10 to 14 pages of text; 2 illustrations)

This section will discuss the DOE's preliminary plans for the performance confirmation program required by 10 CFR 60 Subpart F, Performance Confirmation Program. The program policy for performance confirmation is expected to be fully established over the next year.

6.5.1 Program Plan

This section will discuss the preliminary plan that will be developed for the confirmation program, including the general requirements, geotechnical and design parameters, design testing, and the monitoring and testing of waste packages required in 10 CFR 60 Subpart F.

6.5.2 Code Development and Verification

This section will discuss any known codes and their use, accuracy, and documentation that will be used in developing the design, including the identification and development of new codes to be used in performance confirmation, where possible. The narrative will also explain how the data obtained from testing will be used to modify the codes or to verify their accuracy.

6.5.3 Performance Confirmation Facilities

The narrative will present a preliminary discussion of the repository facilities that might be used in the performance-confirmation program, including any surface facilities used for laboratory testing and diagnostic efforts, instrumentation systems, underground test areas and their intended use, sampling programs, geologic mapping, and the like. Included will be a floor plan of the surface facilities and a plan view of underground testing areas.

Chapter 7

DESIGN ANALYSIS
(18 to 33 pages)

This chapter will discuss the analyses that were conducted in developing the design and identify the impacts of various external factors on the design. In addition, it will discuss the systems, structures, and components that have been identified as important to safety or the methods that will be used to identify them and present preliminary plans for performance confirmation.

7.1 PRECLOSURE DESIGN ANALYSIS
(5 to 10 pages of text; 2 to 4 tables or illustrations)

This section will discuss the approach and techniques used to establish the design and arrangements of the repository facilities.

7.1.1 Approach to the Analysis

The narrative in this section will discuss the design and the analytical methods used to analyze the design for comparison with the functional design criteria, performance criteria, and the required constraints. It will describe and illustrate the design process followed for major repository systems. Where selection among several alternatives is required in the design process, the method or procedure followed in making the selections will be described.

7.1.2 Surface Elements

This section will identify and describe the tools used for the analysis or for establishing the design of the repository surface elements. It will present each analytical method, the analysis performed by the method, and the design area for which it was used, including descriptions of computer codes that identify the author, the name, and the ownership of the code. Included in this discussion will be those site characteristics (wind magnitude and direction, seismicity, rainfall, etc.) that affect the design; these will be both identified and described.

The design parameters will be tabulated along with the range of values for the parameter and the value of the parameter used in design.

The design will be evaluated for its sensitivity to the range of site parameter data currently available. If the design must be modified to accommodate the full range of data for any parameter, then it will be necessary to make a a judgment whether this change is acceptable in terms of performance, feasibility, or economics. If the impact is not acceptable, it will be necessary to determine what range of data for that parameter is required for an acceptable design. The discussion will include plans to obtain the needed data.

7.1.3 Underground Elements

This section will identify and describe the tools used for the analysis or for establishing the design of the repository underground elements. It will present each analytical method with the design area(s) for which it was

used and the analyses that were performed. In addition, it will provide computer-code descriptions that identify the author, the ownership, and the name of the code.

The design values for rock properties (including elastic and inelastic behavior of the rock mass) and the behavior of rock discontinuities (e.g., joints, bedding planes, shear zones) will be used in constitutive models and codes to determine the overall response of the host rock. The narrative will also describe how the mechanical and thermomechanical behaviors of the rock were used in developing the conceptual design of the repository. The effects of naturally induced as well as man induced (as appropriate for each site) ground motion upon the stability of underground openings will be discussed and those design features taken to mitigate these effects identified.

The hydrologic regime will be discussed briefly, and the proposed design measures to control the inflow of ground water into the repository during development, operations, and the postclosure waste-isolation period will be described. The capability of the design to handle large unanticipated water inflows to the underground workings will also be discussed.

The design will be evaluated for its sensitivity to the range of site parameter data currently available. If the design must be modified to accommodate the full range of data for any parameter, then it will be necessary to make a judgment whether this change is acceptable in terms of performance, feasibility, or economics. If the impact is not acceptable, it will be necessary to determine what range of data for that parameter is required for an acceptable design. The discussion will include plans to obtain the needed data.

The site characteristics to be included in this analysis are (1) ground-water inflow (both that expected and the maximum credible unanticipated amount), temperature, and hydrostatic pressure; (2) rock temperature; (3) hydraulic conductivity; (4) gas inflow (the amount that could be expected as well as the maximum credible unanticipated amount); (5) rock fracture abundance; and (6) rock and rock-mass physical, mechanical, thermal, and thermomechanical properties. The design parameters will be tabulated along with the range of values for the parameter and the value of the parameter used in design.

7.2 POSTCLOSURE DESIGN ANALYSIS

(3 to 5 pages of text; 2 or 3 illustrations; 1 table)

This section will present the techniques and approach that are used to analyze the response of the repository design to the conditions that can be expected to occur after closure.

7.2.1 Approach to the Analysis

The narrative will discuss the methods and rationale used to establish compliance with the postclosure functional design criteria, performance criteria, and required constraints.

7.2.2 Far-Field Effects

The narrative will discuss the analytical methods used to analyze the postclosure impact of expected repository conditions on the site, including

computer-code descriptions that will identify the author, the ownership, and the name of the code. The site characteristics that could affect the analysis results will be identified for each analysis method used, and their effect on the analysis will be quantified wherever possible.

The design parameters will be tabulated along with the range of values for the parameter and the value of the parameter used in design.

The design will be evaluated for its sensitivity to the range of site parameter data currently available. If the design must be modified to accommodate the full range of data for any parameter, then it will be necessary to make a judgment whether this change is acceptable in terms of performance, feasibility, or economics. If the impact is not acceptable, it will be necessary to determine what range of data for that parameter is required for an acceptable design. Included in the discussion will be plans to obtain the needed data.

7.3 ENGINEERING ANALYSIS OF DESIGN
(6 to 10 pages of text, 2 to 3 tables)

This section will describe the approach and techniques used to perform an engineering analysis of the design as opposed to the objective analysis covered in Sections 7.1 and 7.2. It will discuss the characteristics that cannot be treated in a regimented, purely analytical manner as well as their effects on the design.

7.3.1 Site Characteristics Affecting Design

Covered in this section will be the site characteristics that affect the design on a large scale, including such features as formation thickness, lateral and vertical continuity and dips, faulting, folding, piping and spatial variability of rock mass properties. Such conditions and their effects on the design must be considered even though they cannot be treated in a purely mathematical manner; they must be treated in a subjective way. The ability of the design to handle these features will be described to illustrate the design flexibility achieved.

7.3.2 The Effect of Construction Techniques

The methods used for excavating the repository drifts may create a disturbed rock zone. The potential for this will be assessed and described in this section, including any special actions taken to minimize the propagation of fractures that could be potential radionuclide-migration pathways and taking into consideration the expected rock conditions at the site. This section will also explain how the planned excavation techniques match the expected site characteristics and rock-mass properties and will discuss the construction techniques that affect how the repository is designed to fit within the site (i.e., tunnel boring versus drilling and blasting), as well as potential effects on the long-term waste-isolation capability of the site.

7.3.3 The Effect of the Exploratory-Shaft Facility

This section will evaluate the effect of incorporating the exploratory-shaft facility (ESF) into the repository. Significantly different arrangements that were considered and their relative merits will be described. The function of the ESF during the construction of the repository

will also be discussed. A description of the evaluation made to determine whether the site suitability will be compromised by construction of the ESF will be included. The steps to be taken to ensure that the site integrity is not impacted by the shaft operation seals will be outlined.

7.4 SYSTEMS, STRUCTURES, AND COMPONENTS IMPORTANT TO SAFETY
(2 to 4 pages of text; 2 to 4 tables)

This section will discuss the analyses that were made to identify those repository systems, structures, and components that are important to safety. Where a rigorous analytical identification has not been made, the methods and criteria that will be used will be described, and preliminary identifications will be based on engineering judgment. For this preliminary hazards analysis, the potential hazards inherent in the repository system (i.e., rock falls) will be identified and their effects evaluated. This preliminary analysis will identify potential problem areas requiring a more detailed analysis, including the methods for performing such analyses.

7.5 ANALYSIS CONCLUSIONS
(2 to 4 pages of text; 2 to 4 tables)

This section will summarize the conclusions reached regarding the design of the repository as a result of the analyses described in this chapter.

Chapter 8

DESIGN ISSUES AND DATA NEEDS
(75 to 100 pages)

This chapter will identify the engineering design information needs identified during the SCP design phase. It will include the following:

- Identification of design information needs and whether the need requires site-characterization data, and a brief rationale for the need and where the resolution of the need will be incorporated into the design (regardless of need for site-characterization data)

- Identification of resolved information needs and a brief description of the resolution

- Current status of unresolved information needs, including progress to date and the information that remains to be determined

- Plans to resolve (or identify where such plans can be found) unresolved information needs, including engineering studies, research and development, and site-characterization data required for the resolution

The number of pages in this chapter will depend on site-specific information needs.

Chapter 9

QUALITY ASSURANCE
(1 to 5 pages)

The QA program plans and procedures that were in place during the conduct of the work reported in the SCP conceptual design will be defined primarily through references to appropriate QA documents.

APPENDIX 1

CORRELATION BETWEEN THE SCP CHAPTER 6 OUTLINE
AND THE SCP-CD REPORT OUTLINE

SCP Chapter 6 - Outline	Correlating Section From The SCP-CDR Outline
6.0 Introduction	1
6.1 Design Basis	2
6.1.1 Repository Design Requirements	2.1, 2.2, 2.4, 2.5, 2.6
6.1.2 Reference Design Data Base	2.3
6.1.3 Analytical Tools for Geotechnical Design	7
6.1.4 Structures, Systems, and Components Important to Safety	2.7, 4.6, 7.4
6.1.5 Barriers Important to Waste Isolation	4.6, 7.4, 5.1, 5.2, 5.3, 6.4
6.2 Current Repository Design Description	3, 4
6.2.1 Background	1
6.2.2 Overall Facility Design	3.1, 3.2, 3.3, 3.4
6.2.3 Repository Operations	3.1, 3.2, 3.3, 4.5, 6.3
6.2.4 Design of Surface Facilities	4.1, 4.2
6.2.4.1 Foundation Considerations	4.1
6.2.4.2 Flood Protection	4.2
6.2.5 Shaft and Ramp Design	4.3
6.2.6 Subsurface Design	4.4
6.2.6.1 Excavation, Development, and Ground Support	3.4, 4.4, 6.4
6.2.6.2 Ground-Water Control	3.3, 4.4
6.2.6.3 Ventilation	3.4, 4.4
6.2.7 Backfill of Underground Opening	3.1, 5.1
6.2.8 Shaft and Borehole Seals	5
6.2.8.1 Shaft Seal Characteristics	5.2
6.2.8.2 Shaft Seal Emplacement	5.2
6.2.8.3 Borehole Seal Characteristics	5.3
6.2.8.4 Borehole Seal Emplacement	5.3
6.3 Assessment of Design Information Needs	6, 7, 8
6.3.1 Introduction	6, 7, 8
6.3.2 Design of Underground Openings	7.1, 7.3, 6.5, 8
6.3.3 Backfill	7.2
6.3.4 Strength of Rock Mass	7.1, 7.2, 7.3, 8
6.3.5 Sealing of Shafts, Boreholes, and Underground Openings	7.2, 7.3, 8
6.3.6 Construction	7.3, 8
6.3.7 Design of Surface Facilities	7.1, 8
6.3.8 Repository System Component Performance Requirements	6
6.4 Summary of Design Issues and Data Needs	8