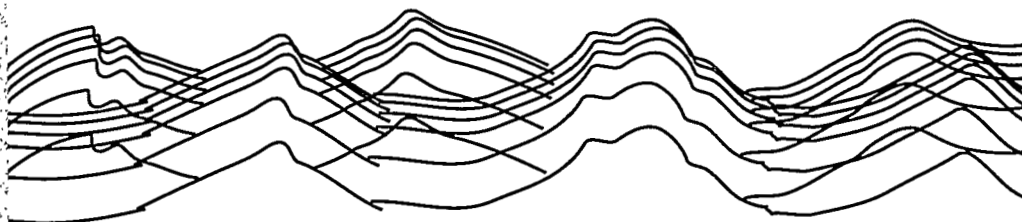


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DOE/RW-0206

SITE CHARACTERIZATION PLAN  
*Public Handbook*

Yucca Mountain, Nevada  
January 1989

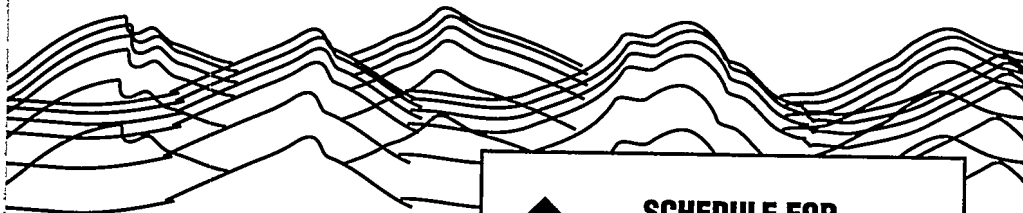



U.S. Department of Energy  
Office of Civilian Radioactive Waste Management

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**MAST**

CP



 <b>SCHEDULE FOR THE REPOSITORY</b>	
<b>2003</b>	Begin Receiving Spent Fuel and High-Level Waste at the Repository
<b>1998</b>	Start Repository Construction
<b>1995</b>	Submit License Application to Nuclear Regulatory Commission
<b>1994</b>	Environmental Impact Statement
<b>DECEMBER 1988</b>	Site Characterization Plan
<b>DECEMBER 1987</b>	Yucca Mountain Desig- nated by Congress as Candidate Site
<b>1982</b>	Nuclear Waste Policy Act

## **DISCLAIMER**

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## **DISCLAIMER**

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DOE/RW--0206

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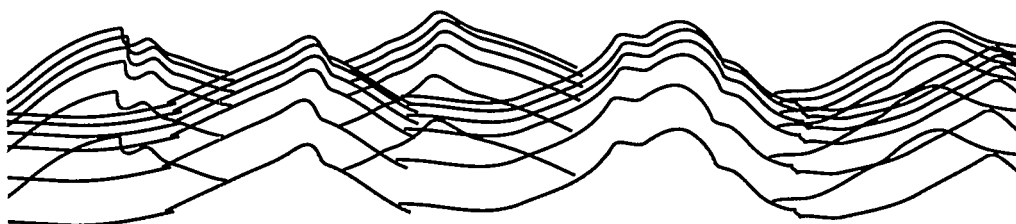
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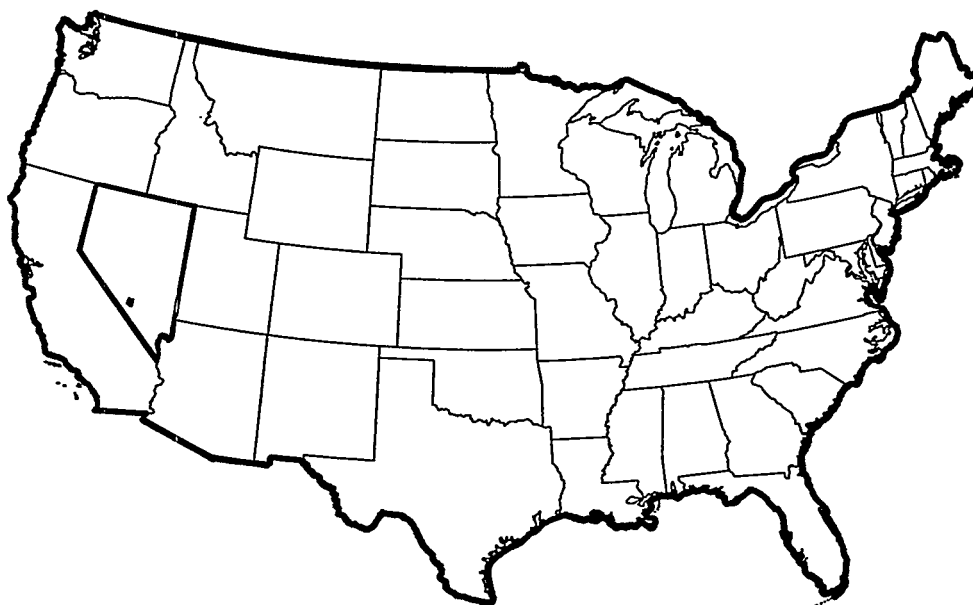
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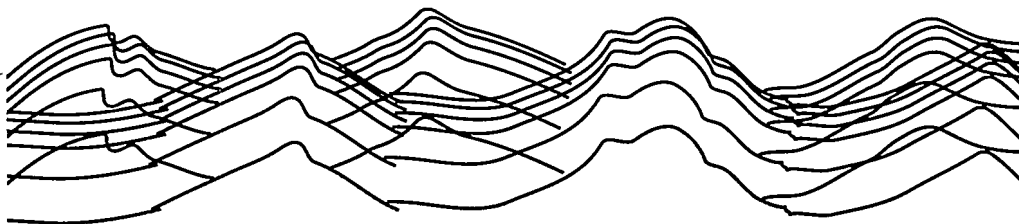
# *Introduction*



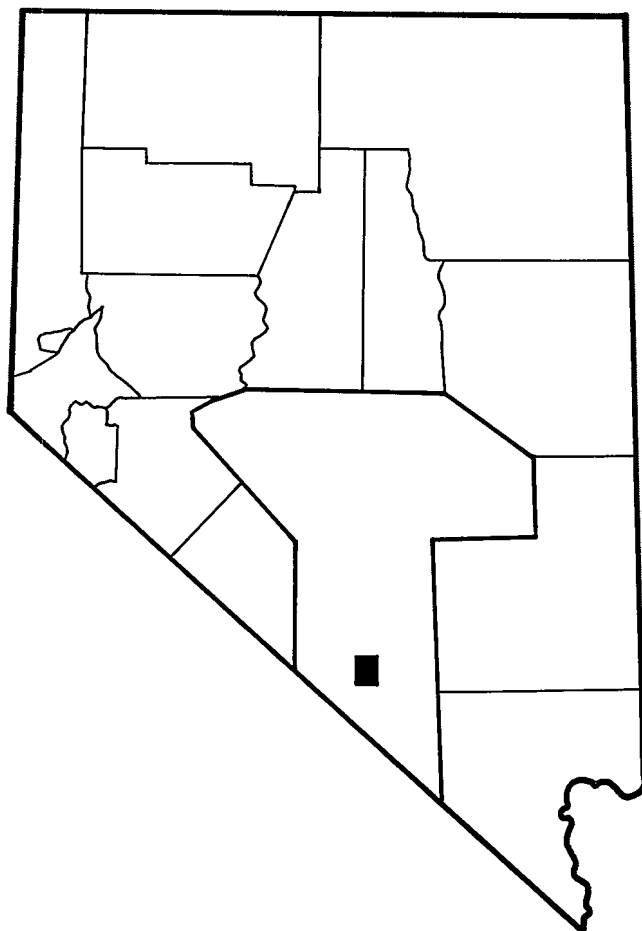
The Yucca Mountain site in Nevada has been designated by the Nuclear Waste Policy Act of 1982, as amended, for detailed study as the candidate site for the first U.S. geologic repository for spent nuclear fuel and high-level radioactive waste. The detailed study – called "site characterization" – will be conducted by the Department of Energy (DOE) to determine the suitability of the site for a repository and, if the site is suitable, to obtain from the Nuclear Regulatory Commission authorization to construct the repository.

As part of the site characterization study, DOE has prepared a Site Characterization Plan (SCP) for the Yucca Mountain site. The Site Characterization Plan is a nine-volume document, approximately 6,300 pages in length, which describes the activities that will be conducted to characterize the geologic, hydrologic, and other conditions relevant to the suitability of the site for a repository.





# *Part 1*





## **Q. WHAT IS THE PURPOSE OF THIS HANDBOOK?**

**A. This Handbook is a guide to help interested citizens understand, locate and use the information contained in the Site Characterization Plan.**

Part 1 of this Handbook explains what site characterization is and how the Site Characterization Plan (Plan) relates to it. Part 2 tells how to locate subjects covered in the Plan.

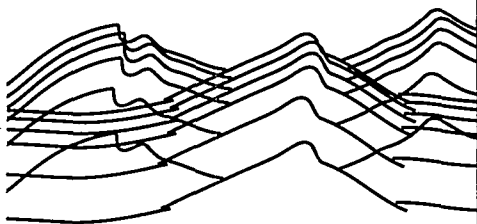
Another major purpose of this Handbook is to identify opportunities for public involvement in the review of the Site Characterization Plan. DOE wants to be sure that the public has adequate opportunities to learn about the Plan and review the results of the subsequent technical studies. Therefore, citizens may review the Plan at public libraries and DOE reading rooms, locations of which are listed on pages 26-28 of this Handbook. Or, they may prefer to request the **Site Characterization Plan Overview**, a much shorter document, which consists of brief summaries of selected topics covered in the Site Characterization Plan. Copies of the Site Characterization Plan Overview, or the Plan itself, are available upon request from the address below.

**Yucca Mountain Project Office  
U.S. Department of Energy  
Box 98518  
Las Vegas, Nevada 89193**

Citizens may also write to the address above and request to be placed on the mailing list for future information concerning site characterization and the program.

## **Q. WHAT IS SITE CHARACTERIZATION?**

**A. Site characterization is an ongoing, long-term process designed to explore the conditions and characteristics of the candidate site for a geologic repository.**



The purpose of site characterization is to assess a site's suitability to be a repository. To do this, DOE must study the geology, the surface and ground-water systems, and the potential for earthquakes and severe weather at Yucca Mountain. Many tests are required to evaluate the suitability and performance of the site.

Some studies can be done in laboratories, but others require exploration and testing at the site, including constructing "exploratory" shafts and conducting tests underground in the exploratory shaft facility and at the depth of the proposed repository.

Other types of testing and evaluation include environmental, socioeconomic, and transportation studies. While not directly part of site characterization, these studies are very important steps in evaluating the possible effects of a repository on people and the environment; and in finding ways to avoid, eliminate, or mitigate any potential negative effects.

In addition to public involvement, various governmental entities are provided an opportunity to review DOE activities. These include the Nuclear Regulatory Commission, the State of Nevada, and affected units of local governments as designated by the Secretary of Energy.

## **Q. WHAT IS THE SITE CHARACTERIZATION PLAN (SCP)?**

**A. The Site Characterization Plan is a detailed work plan for activities that DOE intends to conduct during the next six-to-seven years to see if the Yucca Mountain site is suitable for construction of a geologic repository.**

The Site Characterization Plan is organized into two parts.

Part A (Chapters 1 through 7):

- Describes the site, the preliminary designs for the waste package (i.e., the waste and the container in which it is packaged for disposal) and the repository, and the nature of the rock in which the waste package would be placed;

Part B (Chapter 8)

- Identifies the technical questions related to the candidate site at Yucca Mountain and the information needed to answer them; and
- Outlines the studies needed to obtain the information that will be analyzed by DOE to answer these technical questions. The information from these studies will be analyzed by DOE to determine whether the site is suitable for a repository.

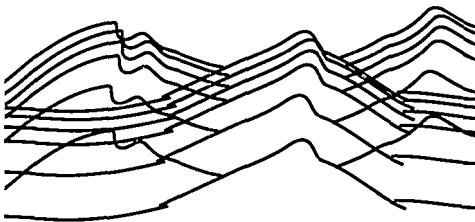
The Plan is required by the Nuclear Waste Policy Act of 1982 (NWPA), as amended, and by Nuclear Regulatory Commission regulations.

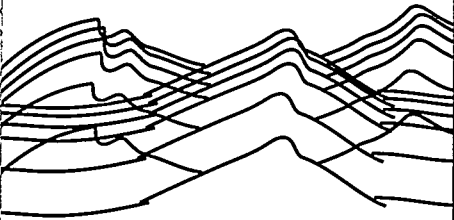
## **Q. WHAT IS THE ROLE OF THE PUBLIC IN THE SCP?**

**A. The public has ongoing opportunities to be informed about and participate in the Site Characterization Plan either directly or through their State and local officials.**

During 1987, both the State of Nevada and the Nuclear Regulatory Commission had the opportunity to review draft SCP chapters that were provided for their information while the document was being written. In January 1988, a Consultation Draft Site Characterization Plan was developed by DOE to solicit comments from the Nuclear Regulatory Commission and the State. Workshops were held in Nevada and Washington, D.C., to discuss SCP technical issues and strategies for resolving these issues. Comments on the consultation draft received prior to July 1988 were considered in preparing the Plan that now has been issued for public comment. Comments received after this date will be addressed in semi-annual Progress Reports to be issued by DOE. These Progress Reports will summarize the results of site characterization activities and will explain any changes that may be made in the test program as information is collected and evaluated.

In addition, the Site Characterization Plan process has been highlighted in the Yucca Mountain Project Office public information activities. Information about the Plan has been the focus of more than 75 presentations given to government, business, civic, service, and social groups during 1988. The scientific studies outlined in the Consultation Draft Site Characterization Plan were discussed in a series of meetings held in southern, south-central, and northern Nevada during the first half of





1988. These meetings were announced to the public and provided an opportunity for interactions between DOE and interested persons. Several public exhibit showings around the State also have provided information to the public about the Site Characterization Plan and process.

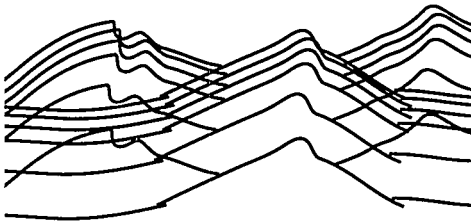
Public involvement is encouraged to continue through the review and comment period that will occur for 90 days after the Plan is issued. During February, Yucca Mountain Project Office Update Meetings will be held throughout Nevada to inform the public about the status of the program and the purpose and content of the Site Characterization Plan. These meetings will be widely advertised. Those persons whose names are on repository program mailing lists will be notified, and meeting information will be provided to the news media. The public is encouraged to attend these meetings. About one month after the Update Meetings, public comment will be solicited through public hearings, which will be announced in a manner similar to the Update Meetings. In addition, the attached form may be used to submit written comments on the Site Characterization Plan to:

**SCP Comments  
Yucca Mountain Project Office  
U.S. Department of Energy  
Box 98518  
Las Vegas, Nevada 89193**

Comments received during the 90-day comment period will be considered and any changes in the Site Characterization Program as a result of these comments will be noted in future Progress Reports.

These reports will summarize results of site characterization studies, identify new issues, describe changes in study plans, identify decision points reached, and note schedule changes where appropriate. Progress in developing repository and waste package designs will also be reported.

In addition to the Progress Reports, DOE plans to continue to hold Yucca Mountain Project Update Meetings to keep the public informed about site characterization in a timely manner. Also, details of the scientific studies will continue to be featured in other public information activities, and Progress Reports will be available at local libraries and the Yucca Mountain Information Office in Beatty, Nevada.

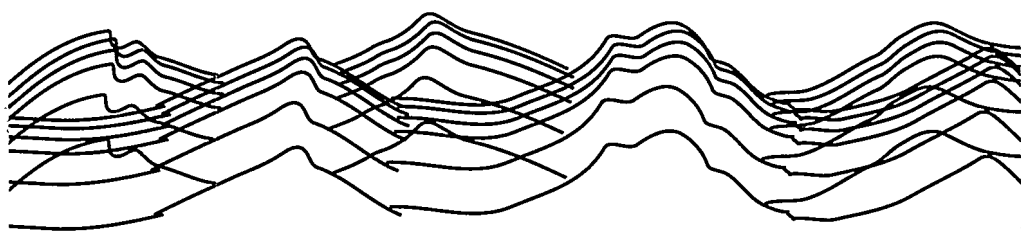


## **Q. HOW CAN THE PUBLIC SUBMIT COMMENTS ON THE SCP?**

**A. The public can  
submit comments  
in writing or in  
person at the  
public hearings.**

Included in this Handbook is a form which can be used for convenience in submitting written comments although it is not required. This form may be photocopied, or additional forms can be obtained from the DOE office listed on page 9. These comments may be sent directly to DOE or may be presented during public hearings to be held approximately one month before the end of the 90-day public comment period. Exact times and locations will be announced in the Federal Register and through local news media. Comments can be made either orally or in writing, or both.

All comments received during the 90-day public comment period become part of the official record for the Site Characterization Plan, and DOE will consider them in the site characterization program. As mentioned before, DOE will hold Project Update Meetings after the comment period to describe how the comments will be considered and how any newly identified issues will be incorporated into the studies. In addition, the Progress Reports will be issued at 6-month intervals.





Return Address

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Place  
Postage  
Here

SCP Comments  
Yucca Mountain Project Office  
U.S. Department of Energy  
Box 98518  
Las Vegas, Nevada 89193

## COMMENT FORM

This form may be used to submit written comments on the Site Characterization Plan for Yucca Mountain, NV. Upon completion of the form, please fold, staple, and post the form to the address on the reverse side.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip Code \_\_\_\_\_

Please check if you wish to receive:

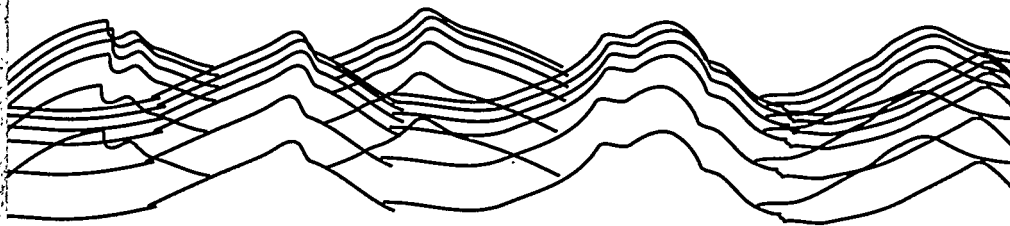
☐ Notification of Project Update Meetings on Yucca Mountain, NV

Comments \_\_\_\_\_

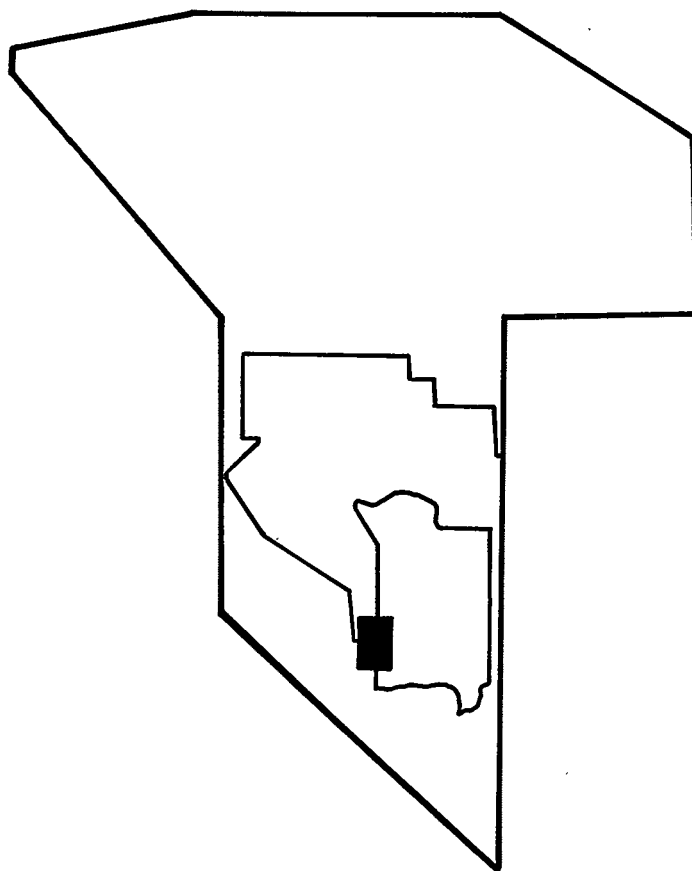
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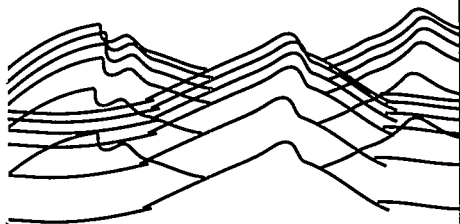


## *Part 2*



## **Q. WHAT DOES THE SCP CONTAIN?**

**A. The Site Characterization Plan is a technical document that tells what information is currently available about the Yucca Mountain site, describes the additional information that must be collected in order to determine whether the site is suitable for a repository, and outlines DOE's plan to obtain this information.**

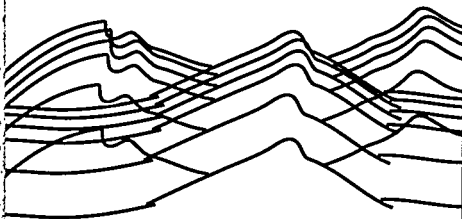


The primary approach that DOE took in preparing the Site Characterization Plan was to analyze all of the legal and regulatory requirements surrounding the siting of a geologic repository for high-level waste. The result of this analysis was to base the Site Characterization Plan on a framework of questions or issues that correspond to those requirements.

This framework is called the "issues hierarchy" in the Site Characterization Plan. It determines levels of importance for the questions to which DOE must find answers in order to assess the suitability of Yucca Mountain as a repository site. Three key issues addressed in the Plan are:

- Performance of the repository after it is permanently closed
- Safety of repository operations before closure
- Ease and cost of repository construction, operation, closure, and decommissioning.

For each key issue, there are performance and design concerns that require specific information. The site characterization program will collect and analyze this information in order to enable DOE to determine the suitability of Yucca Mountain as a potential site for a repository.

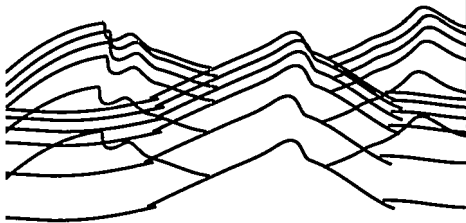


The Site Characterization Plan is divided into two parts.

Part A consists of a table of contents, an introduction, and seven chapters. It summarizes all of the currently available information about the Yucca Mountain site, and it discusses preliminary designs for the proposed repository and the package that will contain the waste.

- Chapter 1 presents the available data on the **geologic conditions** of the site and the region.
- Chapter 2 discusses the **geoengineering properties** of the rock units at the site.
- Chapter 3 discusses the **hydrologic conditions** at the site.
- Chapter 4 presents information on the **geochemical properties** of the site.
- Chapter 5 is concerned with **climate and meteorology**.
- Chapter 6 describes the **preliminary conceptual design of the repository**.
- Chapter 7 addresses **preliminary designs for the waste package**.

Part B describes the details of the site characterization program. It consists of a single chapter (Chapter 8) and begins with an introduction that gives a simple description of the approach DOE used



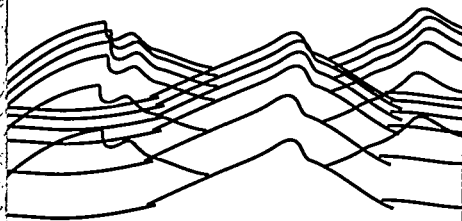
in planning the site characterization program. Section 8.1 explains the issues hierarchy and the issue-resolution strategy. Section 8.2 lists the complete issues hierarchy for the Yucca Mountain site.

Section 8.3 is very significant, and by far the longest Section of Part B. It consists of five subsections. Section 8.3.1 describes the investigations that DOE will conduct to obtain the site-related information needed for resolving performance and design issues. This plan for obtaining information about the site is divided into 16 different characterization programs, such as geohydrology, geochemistry, or postclosure tectonics.

Section 8.3.2 presents DOE's plan for resolving issues that are related to the design of the repository. It describes the tests and analyses that will be performed to support the design, specifies what information about the site is needed for the design, and explains how this information will be obtained.

The next part, Section 8.3.3, describes DOE's plans for resolving issues related to the seals for the openings in the repository (shafts, boreholes, etc.). Plans for resolving issues related to the design of the waste package are given in Section 8.3.4. Section 8.3.5 details DOE's plans for assessing the performance of the repository.

Section 8.4 describes the activities that DOE will conduct at the Yucca



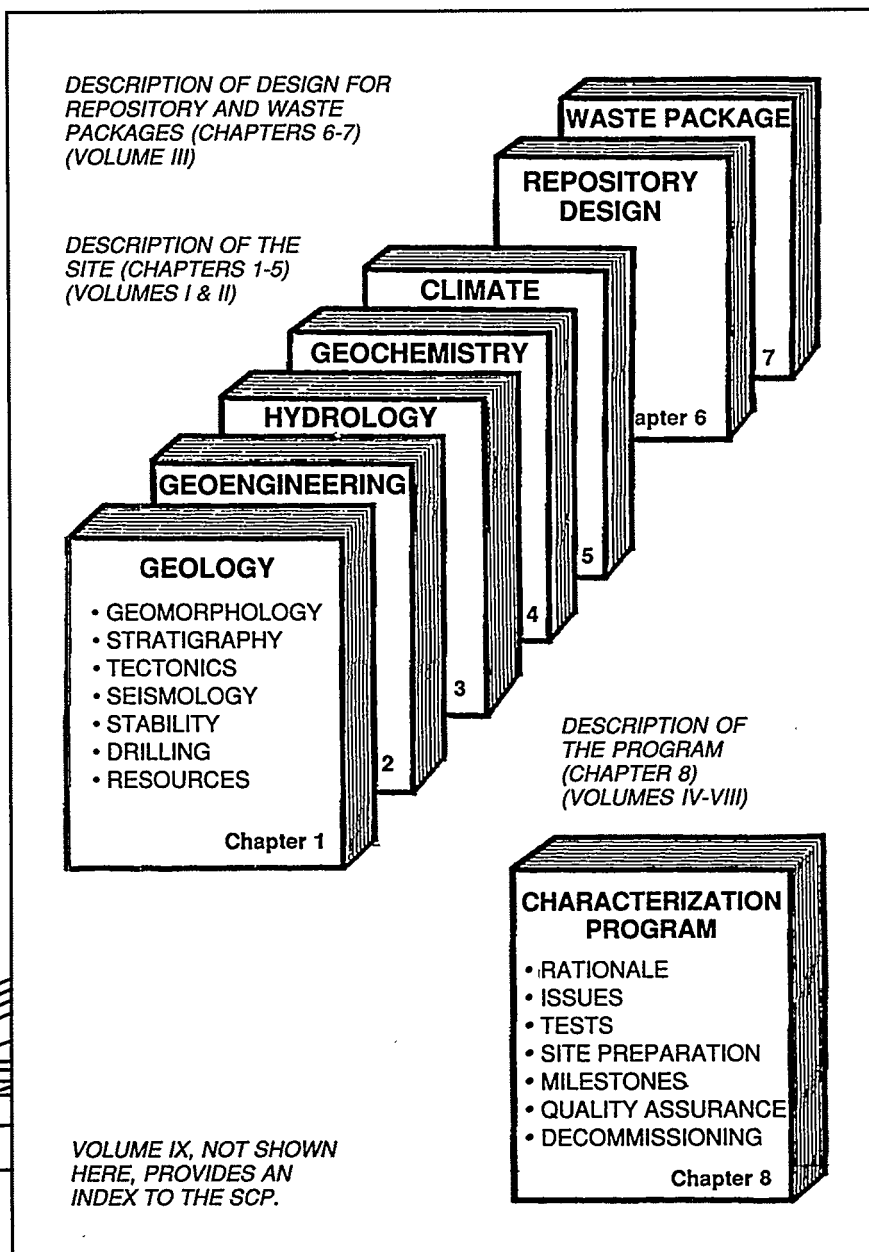
Mountain site. It describes the site-preparation activities that are needed for characterization; discusses the various surface-based tests that will be performed, such as drilling boreholes; describes the construction of the two exploratory shafts and the underground testing facilities related to the exploratory shafts; and explains the testing to be performed in the exploratory shafts and underground areas. Section 8.4 also tells about the analyses DOE has done to ensure that the sinking of the shafts and boreholes will not have any adverse effects on the ultimate performance of the site, as a geologic repository.

The remainder of Chapter 8 covers milestones, decision points, and schedules (Section 8.5); quality assurance (Section 8.6); and decontamination and decommissioning (Section 8.7).

As an aid in finding specific information, the Site Characterization Plan provides an expanded table of contents of more than 60 pages in Volume I that outlines all of the detailed descriptions and activities. It is the most useful tool for moving through the various sections of the Plan.

To help in this process, a more general table of contents is included here. It will aid the reader in determining which section of the Plan is most relevant to his or her concerns. This is followed by a list of the libraries and DOE reading rooms where the entire document may be reviewed.

## ORGANIZATION OF THE SCP





# SCP GENERAL TABLE OF CONTENTS

## Introduction

### Part A

#### Description of the mined geologic disposal system

##### Introduction

Chapter 1 ..... Geology

Chapter 2 ..... Geoengineering

Chapter 3 ..... Hydrology

Chapter 4 ..... Geochemistry

Chapter 5 ..... Climatology  
and Meteorology

Chapter 6 ..... Conceptual design  
of a repository

Chapter 7 ..... Waste package

### Part B

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##### 8.1 Rationale

##### 8.2 Issues

##### 8.3 Planned tests, analyses, and studies

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###### 8.3.1.1 Site overview

###### 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 and distribution

###### 8.3.1.11 Land ownership and mineral rights

###### 8.3.1.12 Meteorology

###### 8.3.1.13 Offsite installations

## Part B (Contd.)

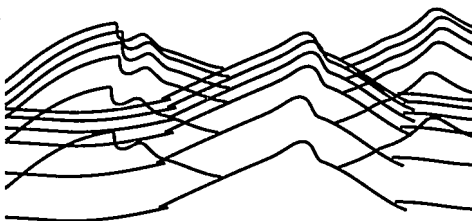
- 8.3.1.14 Surface characteristics
- 8.3.1.15 Thermal and mechanical properties
- 8.3.1.16 Preclosure hydrology
- 8.3.1.17 Preclosure tectonics
- 8.3.2 Repository program
  - 8.3.2.1 Repository overview
  - 8.3.2.2 Configuration of underground facilities (postclosure)
  - 8.3.2.3 Repository design criteria for radiological safety
  - 8.3.2.4 Nonradiological health and safety
  - 8.3.2.5 Preclosure design and technical feasibility
- 8.3.3 Seal program
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  - 8.3.3.2 Seal characteristics
- 8.3.4 Waste package
  - 8.3.4.1 Waste package overview
  - 8.3.4.2 Waste package characteristics (postclosure)
  - 8.3.4.3 Waste package characteristics (preclosure)
  - 8.3.4.4 Waste package production technologies
- 8.3.5 Performance assessment program
  - 8.3.5.1 Strategy for preclosure performance assessment
  - 8.3.5.2 Waste retrievability
  - 8.3.5.3 Public radiological exposures – normal conditions
  - 8.3.5.4 Worker radiological safety – normal conditions

## **Part B (Contd.)**

- 8.3.5.5 Accidental radiological releases
- 8.3.5.6 Higher-level findings – preclosure radiological safety
- 8.3.5.7 Higher-level findings – ease and cost of construction
- 8.3.5.8 Strategy for postclosure performance assessment
- 8.3.5.9 Containment by waste package
- 8.3.5.10 Engineered barrier system release rates
- 8.3.5.11 Seal performance
- 8.3.5.12 Ground-water travel time
- 8.3.5.13 Total system performance
- 8.3.5.14 Individual protection
- 8.3.5.15 Ground-water protection
- 8.3.5.16 Performance confirmation
- 8.3.5.17 NRC siting criteria
- 8.3.5.18 Higher-level findings – postclosure system and technical guidelines
- 8.3.5.19 Completed analytical techniques
- 8.3.5.20 Analytical techniques requiring development
- 8.4 Planned site preparation activities
- 8.5 Milestones, decision points, and schedule
- 8.6 Quality assurance program
- 8.7 Decontamination and decommissioning

## **Glossary and Acronyms**

## DOE Reading Rooms



Albuquerque Operations Office  
U.S. DOE  
Pennsylvania & H Streets  
Kirkland Air Force Base  
Albuquerque, NM 87115

Chicago Operations Office  
U.S. DOE  
9800 South Cass Avenue  
Argonne, IL 60439

DOE Headquarters  
1000 Independence Avenue, SW  
Room 1E-190, MA-232.221  
Washington, DC 20585

Idaho Operations Office  
Technical Library  
785 DOE Place  
Idaho Falls, ID 83402

Nevada Operations Office  
U.S. DOE  
2753 South Highland Drive  
Las Vegas, NV 89193-8518

## DOE Reading Rooms

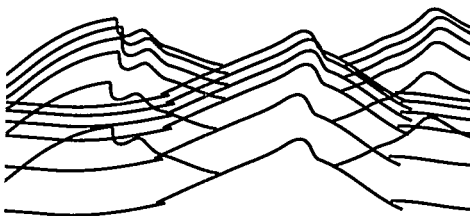
Oak Ridge Operations Office  
U.S. DOE  
200 Administration Road  
Oak Ridge, TN 37830

Richland Operations Office  
U.S. DOE  
825 Jadwin Avenue  
Richland, WA 99352

San Francisco Operations Office  
U.S. DOE  
1333 Broadway  
Oakland, CA 94612

Savannah River Operations Office  
U.S. DOE  
University of South Carolina-Aiken  
Gregg-Graniteville Library  
171 Parkway  
Aiken, SC 29801

## Public Libraries



Yucca Mountain Information Office  
U.S. Department of Energy  
U.S. Route 95 and State Route 374  
Beatty, NV 89003  
(702) 553-2130

Amargosa Valley Community Library  
HCR 69-2  
P.O. Box 401-T  
Amargosa Valley, NV 89020

Beatty Community Library  
P.O. Box 128  
Fourth and Ward  
Beatty, NV 89003

Clark County Library District  
Reference Department  
1401 East Flamingo Road  
Las Vegas, NV 89119

Getchell Library  
University of Nevada-Reno  
Reno, NV 89557-0044

Nevada State Library  
401 North Carson Street  
Carson City, NV 89710

Tonopah Public Library  
171 Central  
Tonopah, NV 89049

U.S. DOE/NV Technical Library  
P.O. Box 98518  
2753 South Highland Drive  
Las Vegas, NV 89193-8518

Washoe County Library  
301 South Center  
Reno, NV 89501

University of Nevada, Las Vegas  
James R. Dickinson Library  
4505 Maryland Parkway  
Las Vegas, NV 89154