

U.S. DEPARTMENT OF ENERGY

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YUCCA MOUNTAIN
SITE CHARACTERIZATION
PROJECT

**MINED GEOLOGIC
DISPOSAL SYSTEM
LICENSE APPLICATION
ANNOTATED OUTLINE**

Volume 1 of 3



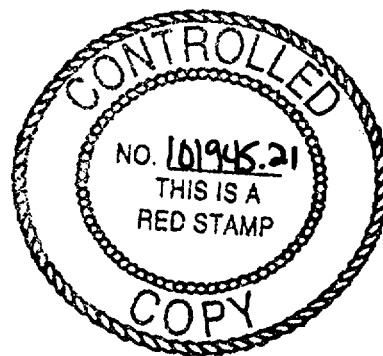
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UNITED STATES DEPARTMENT OF ENERGY

***MINED GEOLOGIC DISPOSAL SYSTEM
LICENSE APPLICATION
ANNOTATED OUTLINE***

YMP/94-05

Revision 0



March 1995

NOTICE

THIS DOCUMENT CONTAINS TEXT AND PLANNING MATERIAL FOR THE FUTURE DEVELOPMENT OF A MINED GEOLOGIC DISPOSAL SYSTEM LICENSE APPLICATION. THIS MATERIAL IS NOT FULLY DEVELOPED, DOES NOT MEET ALL REGULATORY REQUIREMENTS, AND MAY CONTAIN BLANK SPACES WHERE INFORMATION HAS NOT BEEN OBTAINED.

THIS DOCUMENT ALSO CONTAINS STATEMENTS ENCLOSED IN BRACKETS TO HIGHLIGHT THE FACT THAT ALTHOUGH THESE CONCLUSIONS ARE PREMATURE NOW, CONCLUSIONS ON THESE TOPICS WILL ULTIMATELY BE MADE TO DEMONSTRATE REGULATORY COMPLIANCE FOR ANY SITE.

OVERVIEW OF THE ANNOTATED OUTLINE DEVELOPMENT PROCESS

Background

Title 10, Code of Federal Regulations, Part 60, *Disposal of High-Level Radioactive Wastes in Geologic Repositories*, specifies the information to be covered in an application to the NRC for a license to dispose of high-level radioactive waste, including spent nuclear fuel.

One of the regulatory strategies that the U.S. Department of Energy (DOE) is using to support the licensing of a geologic repository is the License Application Annotated Outline (LA AO) process. The LA AO is being prepared on the basis of guidance contained in the NRC Draft Regulatory Guide DG-3003 *Format and Content for the License Application for the High-Level Waste Repository*. In addition, NUREG-1323, *License Application Review Plan for a Geologic Repository for Spent Nuclear Fuel and High-Level Radioactive Waste*, has been issued as a Draft Review Plan and will be used as guidance in future revisions of the LA AO.

The Mined Geologic Disposal System (MGDS) LA AO process is a product-oriented management tool that has a key role in implementing the *Civilian Radioactive Waste Management System Program Plan*, DOE/RW-0458. To demonstrate progress in developing a viable license application, major milestones have been established for annual submittals of the MGDS LA AO to: (1) enable DOE to assess when it has sufficient information to present to the NRC to resolve issues or to decide that site characterization in a specific technical area is complete; (2) present the Office of Civilian Radioactive Waste Management with interpretation of the NRC Format and Content Guide for an MGDS license application in increasing detail and understanding; (3) track specific information needed for licensing from the various Yucca Mountain Site Characterization Project technical efforts in site characterization, design, and performance assessment, as well as from quality assurance; and (4) enable the preparation and submittal of the actual MGDS license application, if the site is found to be suitable for development of a repository.

LA AO Development Process

The LA AO development process consists of two phases. Creation of Planning Packages is the first phase. The Planning Packages are developed by the lead authors designated for each section of the LA AO. Specific forms are utilized to guide the LA AO development process. The authors conceptualize the layout of their respective sections and begin drafting a limited amount of document text as well as identifying required figures and tables. References to be used by the lead authors are also identified. The lead authors then begin to identify information needed from other groups.

The Skeleton Text is the second phase of the LA AO development process. The lead authors

begin to write the proposed text and guidance for the future development of a License Application, building upon the Planning Package framework. All the information has not been obtained for the final document; therefore, the Skeleton Text is not fully developed, does not currently meet all regulatory requirements, and may contain blank spaces where the information has not been obtained. As issues are identified that need to be resolved for the successful licensing of the repository, they are incorporated into the LA AO, as necessary.

Throughout the two phases of LA AO development described above, there will be an iterative process of development, review, and rework. As the repository design effort progresses, more information will become available to incorporate into the LA AO.

The Skeleton Text is formatted in the same manner that the potential License Application will be. Each section of the Skeleton Text will eventually include the following in the sequence given:

- Table of Contents
- List of Tables
- List of Figures
- List of Information Needs
- Section Text
- List of References
- Tables
- Figures
- Information Need Forms

The Skeleton Text is usually written in the present tense. The purpose of this convention is to avoid major rewrites of the LA AO when work begins on the transition into the formal License Application. For example, the LA AO may state that another document has been written or submitted to the NRC when work has not yet started on that particular document. The fact that the document has not been developed or submitted to the NRC is usually indicated by placing [] (brackets) around the sentence, phrase, or paragraph, and an information need number (INN) is assigned as appropriate. The INN is then translated into an Information Need Form that identifies the applicable section number, title, lead and support author name and phone number, and an explicit description of the needed information.

As described above, this document contains statements that are enclosed in brackets to highlight the fact that, although these conclusions are premature now, conclusions on these topics will ultimately be made to demonstrate regulatory compliance for any site.

Date: 03/31/95

MGDS Annotated Outline

TABLE OF CONTENTS

	Page
1.0 GENERAL INFORMATION	1.0-1
1.0.1 Overview of the Proposed Repository	1.0-3
1.0.2 General Layout and Design	1.0-4
REFERENCES	1.0-8
ACRONYMS AND ABBREVIATIONS	1.0-9
1.1 GENERAL FACILITY DESCRIPTION	1.1-1
1.1.1 Site Description	1.1-1
1.1.1.1 General Description	1.1-1
1.1.1.2 Geologic Setting	1.1-1
1.1.1.3 Geologic Repository Operations Area (GROA)	1.1-1
1.1.1.4 Boundaries	1.1-1
1.1.1.4.1 Natural Boundaries	1.1-1
1.1.1.4.2 Manmade Boundaries	1.1-1
1.1.1.5 Site Features	1.1-2
1.1.1.6 Engineered Barriers	1.1-2
1.1.1.7 Roads	1.1-2
1.1.1.8 Transportation Link	1.1-2
1.1.1.9 Natural System	1.1-2
1.1.1.9.1 Geology	1.1-2
1.1.1.9.2 Hydrology	1.1-2
1.1.1.9.3 Geochemistry	1.1-2
1.1.1.9.4 Meteorology and Climate	1.1-2
1.1.2 Design of Major Structures	1.1-2
1.1.2.1 Above Ground Structures	1.1-3
1.1.2.1.1 Permanent	1.1-3
1.1.2.1.2 Temporary	1.1-3
1.1.2.2 Below Ground Structures	1.1-3
1.1.2.2.1 Permanent	1.1-3
1.1.2.2.2 Temporary	1.1-3
1.1.3 Summary of Activities ("Plans")	1.1-3
1.1.3.1 Operation	1.1-3
1.1.3.2 Decommissioning	1.1-3
1.1.3.3 Permanent Closure	1.1-3

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
REFERENCES	1.1-4
1.2 BASIS FOR LICENSE AUTHORITY	1.2-1
REFERENCES	1.2-4
1.3 SCHEDULES	1.3-1
REFERENCES	1.3-2
1.4 CERTIFICATION OF SAFEGUARDS	1.4-1
REFERENCES	1.4-2
1.5 PHYSICAL SECURITY PLAN	1.5-1
1.5.1 Design for Physical Protection	1.5-1
1.5.2 Site Location and Description	1.5-1
1.5.2.1 Site Location	1.5-1
1.5.2.2 Site Description	1.5-1
1.5.2.3 General Site Area Arrangement	1.5-1
1.5.2.4 Activities Within the Site Area Boundary	1.5-1
1.5.2.5 Early Warning Detection Systems	1.5-1
1.5.3 Design Criteria	1.5-1
1.5.4 Design Basis	1.5-2
1.5.5 PSP	1.5-2
1.5.6 Facility Description	1.5-2
1.5.6.1 Storage System Description	1.5-2
1.5.7 Facility Environs	1.5-2
1.5.7.1 Layout	1.5-2
1.5.7.2 MGDS Protected Area Perimeter and Isolation Zone	1.5-2
1.5.7.3 Illumination	1.5-2
1.5.7.4 Assessment	1.5-2
1.5.7.5 Power Systems	1.5-2
1.5.7.6 Mobile Patrols	1.5-2
1.5.7.7 MGDS Protected Area Gates	1.5-2
1.5.7.8 Access Control and Searches	1.5-2
1.5.7.9 Escorts	1.5-2
1.5.7.10 Control of Vehicles Within the MGDS Protected Area	1.5-2
1.5.7.11 Communications	1.5-2
1.5.8 Alarm Station(s)	1.5-2
1.5.8.1 Location and Layout	1.5-2
1.5.8.2 Physical Structure	1.5-2
1.5.8.3 Alarm Monitoring Hardware	1.5-2

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
1.5.9 Security Organization	1.5-2
1.5.10 Security Response	1.5-2
1.5.11 Local and Other Law Enforcement Agencies	1.5-2
1.5.12 Safeguards Contingencies	1.5-2
1.5.13 Background	1.5-2
1.5.13.1 MSSA	1.5-2
1.5.13.2 Perceived Danger	1.5-2
1.5.13.3 Purpose	1.5-2
1.5.13.4 Scope	1.5-2
1.5.14 General Planning Base	1.5-2
1.5.14.1 Event 1 Damage or Degradation of Security Barriers	1.5-2
1.5.14.2 Event 2 Loss or Degradation of MGDS Protected Area Lighting	1.5-2
1.5.14.3 Event 3 Loss or Degradation of Security Communications Systems	1.5-2
1.5.14.4 Event 4 Loss or Degradation of Intrusion Detection Hardware ..	1.5-2
1.5.14.5 Event 5 Loss or Degradation of Alarm Station	1.5-2
1.5.14.6 Event 6 Attempted or Confirmed Intrusion at MGDS Protected Area Perimeter	1.5-3
1.5.14.7 Event 7 Discovery of Unauthorized Personnel, Vehicles within the MGDS Protected Area	1.5-3
1.5.14.8 Event 8 Civil Disturbance	1.5-3
1.5.14.9 Event 9 Unavailability of Security Force	1.5-3
1.5.15 Licensee Planning Base	1.5-3
1.5.15.1 MGDS Management Organization	1.5-3
1.5.15.2 Local and Other Law Enforcement Agencies	1.5-3
1.5.15.3 Access Authorization	1.5-3
1.5.16 Responsibility Matrix	1.5-3
1.5.17 Security Personnel Training Program	1.5-3
1.5.18 Inspections and Tests	1.5-3
1.5.19 Inspections	1.5-3
1.5.20 Tests	1.5-3
1.5.21 Security Record Retention	1.5-3
1.5.22 Security Patrols and Inspections	1.5-3
1.5.23 Maintenance	1.5-3
1.5.24 Unescorted and Escorted Access to the MGDS Protected Area	1.5-3
1.5.24.1 Vehicles	1.5-3
1.5.24.2 Personnel	1.5-3
1.5.25 MGDS Performance Assessment Key Control	1.5-3
1.5.26 Compensatory Measures	1.5-3
1.5.27 Personnel Screening for Unescorted Access Authorization	1.5-3
1.5.28 Security Audits	1.5-3
1.5.29 Quality of the Security System	1.5-3

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
1.5.30 Nuclear material control and accounting program	1.5-3
1.5.31 General Description of Nuclear material control and accounting program ..	1.5-3
1.5.32 Standards for Quality Assurance of Records	1.5-4
1.5.33 Qualifications for Personnel Responsible for Program Implementation and Oversight	1.5-4
1.5.34 Audits of Records	1.5-4
1.5.35 Archiving of Records	1.5-4
REFERENCES	1.5-5
1.6 SITE CHARACTERIZATION PROGRAM REVIEW	1.6-1
1.6.1 Site Characterization Work Conducted	1.6-1
1.6.1.1 Summary of Site Characterization Work	1.6-2
1.6.1.1.1 Site Program (SCP Sec. 8.3.1)	1.6-2
1.6.1.1.1.1 Geohydrology (SCP Sec. 8.3.1.2)	1.6-2
1.6.1.1.1.1.1 Investigation: Studies to provide a description of the regional hydrologic system (SCP Sec. 8.3.1.2.1)	1.6-2
1.6.1.1.1.1.1.1 Study: Characterization of the meteorology for the regional hydrology	1.6-2
1.6.1.1.1.1.1.2 Study: Characterization of runoff and stream-flow (SCP Sec. 8.3.1.2.1.2)	1.6-3
1.6.1.1.1.1.1.3 Study: Characterization of the regional ground-water flow system (SCP Sec. 8.3.1.1.1.3)	1.6-3
1.6.1.1.1.1.1.4 Study: Regional hydrologic system synthesis and modeling (SCP Sec. 8.3.1.1.1.4)	1.6-3
1.6.1.1.1.2 Investigation: Studies to provide a description of the unsaturated zone hydrologic system at the site (SCP Sec. 8.3.1.2.2)	1.6-3
1.6.1.1.1.2.1 Study: Characterization of unsaturated-zone infiltration (SCP Sec. 8.3.1.2.2.1)	1.6-3
1.6.1.1.1.2.2 Study: Water movement tracer tests using chloride and chlorine-36 measurements of percolation at Yucca Mountain (SCP Sec. 8.3.1.2.2.2)	1.6-4
1.6.1.1.1.2.3 Study: Characterization of Yucca Mountain percolation in the unsaturated zone exploratory facility study (SCP Sec. 8.3.1.2.2.4)	1.6-4
1.6.1.1.1.2.4 Study: Diffusion tests on the ESF (SCP Sec. 8.3.2.2.5)	1.6-4
1.6.1.1.1.2.5 Study: Characterization of gaseous-phase movement in the saturated zone (SCP Sec. 8.3.1.2.2.6)	1.6-4

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
1.6.1.1.1.2.6 Study: Hydrochemical characterization of the unsaturated zone (SCP Sec. 8.3.1.2.2.7)	1.6-5
1.6.1.1.1.2.7 Study: Fluid Flow in Unsaturated Fractured Rock (SCP Sec. 8.3.1.2.8)	1.6-5
1.6.1.1.1.2.8 Study: Site Unsaturated-zone Modeling and Synthesis (SCP Sec. 8.3.1.2.2.9)	1.6-5
1.6.1.1.1.3 Investigation: Studies to provide a description of the saturated zone hydrologic systems (SCP Sec. 8.3.1.2.3)	1.6-5
1.6.1.1.1.2 Geochemistry (SCP 8.3.1.3)	1.6-5
1.6.1.1.1.2.1 Investigation: Studies to provide information on water chemistry within the potential emplacement horizon and along flow paths (SCP Sec. 8.3.1.3.1)	1.6-5
1.6.1.1.1.2.2 Investigation: Studies to provide information on mineralogy, petrology, and rock chemistry within the potential emplacement horizon and along flow paths (SCP Sec. 8.3.1.3.2)	1.6-5
1.6.1.1.1.2.3 Investigation: Studies to provide information required on stability of minerals and glasses (SCP Sec. 8.3.1.3.3)	1.6-6
1.6.1.1.1.2.4 Investigation: Studies to provide the information required on radionuclide retardation by sorption processes along flow paths to the accessible environment (SCP Sec. 8.3.1.3.4) . . .	1.6-6
1.6.1.1.1.2.5 Investigation: Studies to provide the information required on radionuclide retardation by precipitation processes along flow paths to accessible environment (SCP Sec. 8.3.1.3.5) . . .	1.6-6
1.6.1.1.1.2.6 Investigation: Studies to provide the information on radionuclide retardation by dispersive, diffusive, and advective transport processes along flow paths to the accessible environment (SCP Sec. 8.3.1.3.6)	1.6-6
1.6.1.1.1.2.7 Investigation: Studies to provide the information required on radionuclide retardation by all processes along flow paths to the accessible environment (SCP Sec. 8.3.1.3.7) . . .	1.6-6
1.6.1.1.1.2.8 Investigation: Studies to provide the required information on retardation of gaseous radionuclides along flow paths to the accessible environment (SCP Sec. 8.3.1.3.8)	1.6-6
1.6.1.1.1.3 Rock Characteristics (SCP Sec. 8.3.1.4)	1.6-6

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
1.6.1.1.1.3.1 Investigation: Studies to develop an integrated drilling program and integration of geophysical activities (SCP Sec. 8.3.1.4.1)	1.6-6
1.6.1.1.1.3.2 Investigation: Studies on the geologic framework of the Yucca Mountain Site (SCP Sec. 8.3.1.4.2)	1.6-6
1.6.1.1.1.3.3 Investigation: Investigation of three dimensional models of rock characteristics at the repository site (SCP Sec. 8.3.1.4.3)	1.6-6
1.6.1.1.1.4 Climate Program (SCP Sec. 8.3.1.5)	1.6-6
1.6.1.1.1.4.1 Investigation: Studies to provide the information required on nature and rates of change in climatic conditions to predict future climates (SCP Sec. 8.3.1.5.1)	1.6-6
1.6.1.1.1.4.2 Investigation: Studies to provide the information required on the potential effects of future climatic conditions on hydrologic characteristics (SCP Sec. 8.3.1.5.2)	1.6-6
1.6.1.1.1.5 Erosion (SCP Sec. 8.3.1.6)	1.6-6
1.6.1.1.1.5.1 Investigation: Studies to determine to determine present locations and rates of surface erosion (SCP Sec. 8.3.1.6.1)	1.6-7
1.6.1.1.1.5.2 Investigation: Potential effects of future climatic conditions on locations and rates of erosion (SCP Sec. 8.3.1.6.2)	1.6-7
1.6.1.1.1.5.3 Investigation: Studies to provide the information required to determine the potential effects of future tectonic activity on locations and rates of erosion (SCP Sec. 8.3.1.6.3)	1.6-7
1.6.1.1.1.5.4 Investigation: Potential effects of erosion on hydrologic, geochemical, and rock characteristics (SCP Sec. 8.3.1.6.4)	1.6-7
1.6.1.1.1.6 Rock Dissolution (SCP Sec. 8.3.1.7)	1.6-7
1.6.1.1.1.6.1 Investigation: Rates of dissolution of crystalline and noncrystalline components in tuff (SCP Sec. 8.3.1.7.1)	1.6-7
1.6.1.1.1.7 Tectonics (SCP Sec. 8.3.1.8)	1.6-7
1.6.1.1.1.7.1 Investigation: Studies to provide information required on direct releases resulting from volcanic activity (SCP Sec. 8.3.1.8.1)	1.6-7
1.6.1.1.1.7.2 Investigation: Studies to provide information required on rupture of waste packages due to tectonic events (SCP Sec. 8.3.1.8.2)	1.6-7

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
1.6.1.1.1.7.3	Investigations: Studies to provide information required on changes in unsaturated and saturated zone hydrology due to tectonic events (SCP Sec.8.3.1.8.3) 1.6-7
1.6.1.1.1.7.4	Investigation: Studies to provide information required on changes in rock geochemical properties resulting from tectonic processes (SCP Sec. 8.3.1.8.4) 1.6-7
1.6.1.1.1.7.5	Investigation: Studies to provide the information required by the analysis and assessment investigations of the tectonics program (SCP Sec. 8.3.1.8.5) 1.6-7
1.6.1.1.1.8	Human Interference (SCP Sec. 8.3.1.9) 1.6-7
1.6.1.1.1.8.1	Investigation: Studies to provide the information required on natural phenomena and human activities that might degrade surface markers and monuments (SCP Sec. 8.3.1.9.1) . 1.6-7
1.6.1.1.1.8.2	Investigation: Studies to provide the information required on present and future value of energy, mineral, land, and groundwater resources (Sec. 8.3.1.9.2) 1.6-8
1.6.1.1.1.8.3	Investigation: Studies to provide the information required on potential effects of exploiting natural resources on hydrologic, geochemical, and rock characteristics (Sec. 8.3.1.9.3) 1.6-8
1.6.1.1.1.9	Population (SCP Sec. 8.3.1.10) 1.6-8
1.6.1.1.1.10	Land Ownership (SCP Sec. 8.3.1.11) (See Chapter 9 of the Safety Analysis Report) 1.6-8
1.6.1.1.1.11	Meteorology (SCP Sec. 8.3.1.12) 1.6-8
1.6.1.1.1.11.1	Investigation: Studies to provide data on regional meteorological conditions (SCP Sec. 8.3.1.12.1) 1.6-8
1.6.1.1.1.11.2	Investigation: Studies to provide data on atmospheric and meteorological phenomena at potential locations of surface facilities (SCP Sec. 8.3.1.12.2) 1.6-8
1.6.1.1.1.11.3	Investigation to provide data on the location of population centers relative to wind patterns in the general region of the site (SCP Sec. 8.3.1.12.3) . 1.6-8
1.6.1.1.1.11.4	Investigation: Studies to provide data on potential extreme weather phenomena and their recurrence intervals (SCP Sec. 8.3.1.12.4) 1.6-8

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
1.6.1.1.1.12 Offsite Installation and Operations Program (SCP Sec. 8.3.1.13)	1.6-8
1.6.1.1.1.12.1 Investigation: Determination of nearby industrial, transportation, and military installations and operations (nuclear and nonnuclear) (SCP Sec. 8.3.1.13.1)	1.6-8
1.6.1.1.1.12.2 Investigation: Potential impacts of nearby installations and operations (SCP Sec. 8.3.1.13.2)	1.6-8
1.6.1.1.1.13 Surface Characteristics (SCP Sec. 8.3.1.14) . . .	1.6-8
1.6.1.1.1.13.1 Investigation: Studies to provide the topographic characteristics of potential locations of surface facilities (SCP Sec. 8.3.1.14.1)	1.6-8
1.6.1.1.1.13.2 Investigation: Studies to provide soil and rock properties of potential locations of surface facilities (SCP Sec. 8.3.1.14.2)	1.6-9
1.6.1.1.1.14 Thermal And Mechanical Rock Properties (SCP Sec. 8.3.1.15)	1.6-9
1.6.1.1.1.14.1 Studies to provide the required information for spatial distribution of thermal and mechanical properties (SCP Sec. 8.3.1.15.1)	1.6-9
1.6.1.1.1.14.2 Studies to provide the required information for spatial distribution of ambient stress and thermal conditions (SCP Sec. 8.3.1.15.2)	1.6-9
1.6.1.1.1.15 Preclosure Hydrology Program (SCP Sec. 8.3.1.16)	1.6-9
1.6.1.1.1.15.1 Investigation: Flood recurrence intervals and levels at potential locations surface facilities (SCP Sec. 8.3.1.16.1)	1.6-9
1.6.1.1.1.15.2 Investigation: Location of adequate water supplies (SCP Sec. 8.3.1.16.2)	1.6-9
1.6.1.1.1.15.3 Investigation: Ground-water conditions within and above the potential host rock (SCP Sec. 8.3.1.16.3)	1.6-9
1.6.1.1.1.16 Preclosure Tectonics (SCP Sec. 8.3.1.17)	1.6-9
1.6.1.1.1.16.1 Investigation: Studies to provide required information on volcanic activity that could affect repository design or performance (SCP Sec. 8.3.1.17.1)	1.6-9
1.6.1.1.1.16.2 Investigation: Studies to provide required information on fault displacement that could affect repository design or performance (SCP Sec. 8.3.1.17.2)	1.6-9

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
1.6.1.1.1.16.3 Investigation: Studies to provide required information on vibratory ground motion that could affect repository design or performance (SCP Sec. 8.3.1.17.3)	1.6-9
1.6.1.1.1.16.4 Investigation: Preclosure tectonics data collection and analysis (SCP Sec. 8.3.1.17.4) ..	1.6-9
1.6.1.1.2 Repository Program (SCP Sec. 8.3.2)	1.6-9
1.6.1.1.3 Seal Program (SCP Sec. 8.3.3)	1.6-9
1.6.1.1.4 Waste Package Program (SCP Sec. 8.3.4)	1.6-9
1.6.1.1.5 Performance Assessment Program (SCP Sec. 8.3.5)	1.6-10
1.6.1.2 Differences Between Characterization Work and the SCP	1.6-10
1.6.2 Status of DOE Resolution of NRC Objections	1.6-10
REFERENCES	1.6-11
1.7 STATEMENT OF COMPLIANCE WITH THE PERFORMANCE OBJECTIVES OF 10 CFR 60 AND SUMMARY OF PERFORMANCE ASSESSMENT RESULTS	1.7-1
REFERENCES	1.7-3
2.0 GENERAL INFORMATION FOR THE SAFETY ANALYSIS REPORT	2.0-1
2.0.1 Overview And Summary Of MGDS Project	2.0-1
2.0.2 Safety Analysis Report Organization	2.0-1
2.0.3 Supporting Information	2.0-1
REFERENCES	2.0-2
ACRONYMS AND ABBREVIATIONS	2.0-3
2.1 IDENTIFICATION OF AGENTS AND CONTRACTORS	2.1-1
2.1.1 Design Agents and Contractors	2.1-1
2.1.2 Construction Agents and Contractors	2.1-1
2.1.3 Operations Agents and Contractors	2.1-1
2.1.4 Consultants and Outside Service Organizations	2.1-1
REFERENCES	2.1-2
2.2 MATERIAL INCORPORATED BY REFERENCE	2.2-1
REFERENCES	2.2-2

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
2.3 USE OF NUCLEAR REGULATORY COMMISSION TECHNICAL POSITIONS	2.3-1
2.3.1 Definition of Applicable NRC Technical Positions	2.3-1
2.3.2 Justification of Exceptions	2.3-1
2.3.3 DOE Conformance to NRC Technical Positions	2.3-1
2.3.4 NRC Regulatory Guide Compliance Program	2.3-1
REFERENCES	2.3-2
2.4 REQUIREMENTS FOR FURTHER TECHNICAL INFORMATION	2.4-1
2.4.1 Technical Information Not Supplied	2.4-1
2.4.2 Technical Information Development Programs (TIDPs)	2.4-1
REFERENCES	2.4-2
2.5 RADIOACTIVE MATERIALS	2.5-1
REFERENCES	2.5-2
2.6 LICENSE SPECIFICATIONS	2.6-1
2.6.1 Scope	2.6-1
2.6.2 Probable Subject of License Specification	2.6-1
2.6.3 Variable and Condition	2.6-1
2.6.4 Justification System	2.6-1
REFERENCES	2.6-2
3.0 NATURAL SYSTEMS OF THE GEOLOGIC SETTING	3.0-1
REFERENCES	3.0-2
ACRONYMS AND ABBREVIATIONS	3.0-3
3.1 DESCRIPTION OF INDIVIDUAL SYSTEMS AND CHARACTERISTICS OF THE SITE	3.1-1
3.1.0 Introduction	3.1-1
3.1.1 Geologic System	3.1-1
3.1.1.1 Regional Geology	3.1-2
3.1.1.1.1 Geomorphology and Topographic Features in the Region of the Site	3.1-2
3.1.1.1.2 Stratigraphy and Lithology of the Region	3.1-2
3.1.1.1.2.1 Older Precambrian Crystalline Rocks	3.1-3

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
3.1.1.1.2.2	Precambrian and Lower Cambrian Sedimentary Rocks 3.1-3
3.1.1.1.2.3	Middle Cambrian through Devonian Sedimentary Rocks 3.1-4
3.1.1.1.2.4	Mississippian through Permian Sedimentary Rocks 3.1-4
3.1.1.1.2.5	Mesozoic Rocks 3.1-4
3.1.1.1.2.6	Tertiary Sedimentary Rocks 3.1-5
3.1.1.1.2.7	Tertiary and Quaternary Igneous Rocks 3.1-5
3.1.1.1.2.8	Tertiary and Quaternary Surficial Deposits 3.1-5
3.1.1.1.3	Structural Geology and Tectonic Information . . 3.1-5
3.1.1.1.3.1	Regional Structural Features and Current State of Stress 3.1-6
3.1.1.1.3.1.1	Plate Tectonic Setting 3.1-6
3.1.1.1.3.1.2	Regionally Significant Faults 3.1-7
3.1.1.1.3.1.3	Structural Features and Seismicity 3.1-11
3.1.1.1.3.2	Regional Volcanic Features 3.1-12
3.1.1.1.3.2.1	Silicic Volcanism 3.1-12
3.1.1.1.3.2.2	Basaltic Volcanism 3.1-13
3.1.1.1.3.3	Alternative Tectonic Models 3.1-17
3.1.1.1.4	Seismology 3.1-18
3.1.1.1.4.1	Regional Seismotectonic Setting 3.1-19
3.1.1.1.4.2	Regional Seismicity 3.1-21
3.1.1.1.4.2.1	Distribution of Seismicity 3.1-24
3.1.1.1.4.2.2	Significant Historical Earthquakes 3.1-29
3.1.1.1.4.2.3	State of Regional Tectonic Stress Field 3.1-38
3.1.1.1.4.3	Relation of Seismicity to Geologic/Tectonic Structures and Settings 3.1-39
3.1.1.1.5	Natural Resources 3.1-39
3.1.1.1.5.1	Methods of Mineral-Energy-Resource Assessment 3.1-41
3.1.1.1.5.2	Mineral Commodities Data 3.1-42
3.1.1.1.5.2.1	Precious- and Base-Metal Deposits 3.1-43
3.1.1.1.5.2.2	Industrial Minerals and Rocks 3.1-49
3.1.1.1.5.3	Geothermal Resources 3.1-53
3.1.1.1.5.4	Hydrocarbon Resources 3.1-56
3.1.1.1.5.5	Conceptual Models of Resource Formation . . . 3.1-59
3.1.1.1.6	Geophysics 3.1-64
3.1.1.2	Site Geology 3.1-64
3.1.1.2.1	Geomorphology and Topographic Features of the Site Area 3.1-64
3.1.1.2.1.1	Erosion at the Site 3.1-64
3.1.1.2.2	Stratigraphy and Lithology of the Site 3.1-65

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
3.1.1.2.2.1	Introduction 3.1-65
3.1.1.2.2.2	Pre-Cenozoic Rocks 3.1-66
3.1.1.2.2.3	Mid-Tertiary Pyroclastic Rocks 3.1-67
3.1.1.2.2.4	Younger Basalt 3.1-75
3.1.1.2.2.5	Surficial Deposits 3.1-75
3.1.1.2.3	Site Structural Geology and Tectonics 3.1-78
3.1.1.2.3.1	Faulting at Yucca Mountain 3.1-78
3.1.1.2.3.2	Quaternary Faulting History 3.1-78
3.1.1.2.3.2.1	Quaternary Faults Within 20 km of the Site . . 3.1-79
3.1.1.2.3.2.2	Significant Quaternary Faults between 20 and 100 km of the Site 3.1-83
3.1.1.2.3.3	Folding at Yucca Mountain 3.1-89
3.1.1.2.3.4	Fractures at Yucca Mountain 3.1-90
3.1.1.2.3.5	Volcanism at Yucca Mountain 3.1-90
3.1.1.2.3.5.1	Silicic Volcanism 3.1-90
3.1.1.2.3.5.2	Basaltic Volcanism 3.1-92
3.1.1.2.3.5.2.1	Basalt of the Silicic Episode 3.1-93
3.1.1.2.3.5.2.2	Postcaldera Basalt of the YMR 3.1-95
3.1.1.2.3.5.2.3	The Lathrop Wells Center 3.1-106
3.1.1.2.3.5.2.4	Tectonic Setting in Relation to Basaltic Volcanism 3.1-106
3.1.1.2.3.5.2.5	Petrologic and Geochemical Constraints on Basaltic Volcanism 3.1-106
3.1.1.2.3.5.2.6	Summary of Basaltic Volcanism 3.1-107
3.1.1.2.4	Seismology 3.1-107
3.1.1.2.4.1	Local Site Seismicity 3.1-107
3.1.1.2.4.1.1	Northern NTS 3.1-108
3.1.1.2.4.1.2	Southern NTS 3.1-109
3.1.1.2.4.1.3	Northern Amargosa Valley - Sarcobatus Flat 3.1-109
3.1.1.2.4.1.4	Northern Death Valley Region 3.1-110
3.1.1.2.4.1.5	1992 M_L 5.6 Little Skull Mountain Earthquake 3.1-110
3.1.1.2.4.2	Ground Motion Model 3.1-111
3.1.1.2.4.2.1	Introduction 3.1-111
3.1.1.2.4.2.2	Characteristics of Ground Motions at Yucca Mountain 3.1-115
3.1.1.2.4.3	Seismic Hazard Assessment 3.1-119
3.1.1.2.4.3.1	Summary of Site Response Model Required for Seismic Hazard Assessment 3.1-119
3.1.1.2.4.3.2	Data Analysis Methodology for Development of Site Response Model 3.1-119
3.1.1.2.4.3.3	Estimation of Uncertainties 3.1-120

TABLE OF CONTENTS (continued)

	Page
3.1.1.2.4.3.4	Characteristics of Site Response at Yucca Mountain 3.1-120
3.1.1.2.4.4	Identification of Seismic Sources 3.1-123
3.1.1.2.5	Natural Resources 3.1-124
3.1.1.2.6	Geophysics 3.1-124
3.1.1.2.7	Geoengineering 3.1-124
3.1.1.2.7.1	Three-Dimensional Geoengineering Model . . 3.1-125
3.1.1.2.7.1.1	Stratigraphic Framework for Testing/ Analysis 3.1-125
3.1.1.2.7.1.2	Geographic Distribution of Holes 3.1-126
3.1.1.2.7.2	Spatial Variability and Sampling Approach . . 3.1-126
3.1.1.2.7.3	Mechanical Properties of Intact Rock 3.1-126
3.1.1.2.7.3.1	Elastic Properties 3.1-127
3.1.1.2.7.3.2	Compressive Strength 3.1-129
3.1.1.2.7.3.3	Tensile Strength 3.1-134
3.1.1.2.7.3.4	Shear Strength of Intact Rock and Triaxial Test 3.1-134
3.1.1.2.7.3.5	Time-Dependent (Creep) Properties of Rock 3.1-136
3.1.1.2.7.4	Mechanical Properties of Discontinuities . . . 3.1-136
3.1.1.2.7.4.1	Properties of Natural vs. Simulated Discontinuities 3.1-137
3.1.1.2.7.4.2	Effect of Infilling on Joint Properties 3.1-138
3.1.1.2.7.4.3	Properties of Healed and Unhealed Joints . . . 3.1-138
3.1.1.2.7.4.4	Effect of Test Conditions on Joint Properties 3.1-138
3.1.1.2.7.4.5	Time-Dependent (Short-Term) Behavior of Joints 3.1-138
3.1.1.2.7.4.6	Time-Dependent (Creep) Properties of Joints 3.1-140
3.1.1.2.7.5	Nature and Extent of Joints at the Yucca Mountain Site 3.1-140
3.1.1.2.7.6	Mechanical Properties of Rock Mass 3.1-142
3.1.1.2.7.6.1	Rock Mass Rating (RMR) System and Q Rating 3.1-142
3.1.1.2.7.6.2	Rock Mass Time-Dependent Properties at Elevated Temperature 3.1-142
3.1.1.2.7.7	Thermal Properties of Intact Rock 3.1-142
3.1.1.2.7.7.1	Thermal Conductivity 3.1-142
3.1.1.2.7.7.2	Heat Capacity of Intact Rock 3.1-142
3.1.1.2.7.7.3	Thermal Expansion 3.1-142
3.1.1.2.7.8	Thermal Properties of Rock Mass 3.1-142
3.1.1.2.7.8.1	Rock Mass Thermal Properties Measured In Situ 3.1-142

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
3.1.1.2.7.8.2	Rock Mass Thermal Properties vs. Intact Rock Thermal Properties 3.1-142
3.1.1.2.7.8.3	Rock Mass Thermal Properties During Cooling Phase 3.1-142
3.1.1.2.7.9	Existing Stress Field 3.1-142
3.1.1.2.7.10	Special Engineering Properties 3.1-142
3.1.1.2.7.11	Engineering Properties of Surficial Material . 3.1-142
3.1.1.2.7.12	Excavation Characteristics of Rock Mass . . 3.1-142
3.1.1.2.7.13	Estimated Water Inflow 3.1-142
3.1.1.2.7.14	Ground Support Requirements 3.1-142
3.1.1.2.7.15	Overview of Mechanical, Thermal, and Thermomechanical Models Using Geoengineering Properties 3.1-142
3.1.1.3	Future Variation in Geologic Process 3.1-142
3.1.2	Hydrologic System 3.1-143
3.1.2.1	Surface Water Hydrology 3.1-143
3.1.2.1.1	Description of Surface-Water Bodies and Physical Characteristics of Drainage Areas . . 3.1-144
3.1.2.1.2	Surface-Water Monitoring Network 3.1-146
3.1.2.1.3	Water Control Structures and Diversions . . 3.1-149
3.1.2.1.4	Flood History 3.1-150
3.1.2.1.5	Flood Potential 3.1-151
3.1.2.1.6	Chemical Composition of Identified Bodies of Surface-Water 3.1-155
3.1.2.1.7	Location, Quantity, and Quality of Surface Water Extracted 3.1-156
3.1.2.1.8	Projected Surface-Water Uses 3.1-157
3.1.2.2	Regional Hydrogeology 3.1-157
3.1.2.2.1	Regional Flow System Boundaries and Hydrogeologic Units Overview 3.1-157
3.1.2.2.1.1	Hydrogeologic Units 3.1-158
3.1.2.2.1.2	Basis for Defining the Physical Boundaries of the Regional Hydrogeologic Systems . . . 3.1-159
3.1.2.2.2	Potentiometric Levels and Hydraulic Gradients 3.1-162
3.1.2.2.3	Characteristics Of Hydrogeologic Units . . . 3.1-164
3.1.2.2.4	Recharge and Discharge 3.1-169
3.1.2.2.5	Age of Regional Groundwater 3.1-169
3.1.2.2.6	Groundwater Flow Paths 3.1-169
3.1.2.2.7	Regional Paleohydrology 3.1-169
3.1.2.2.8	Regional Groundwater Use 3.1-178
3.1.2.2.9	Regional Groundwater Management Plans . . 3.1-184
3.1.2.3	Site Hydrogeology 3.1-188

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
3.1.2.3.1	Baseline Monitoring Network 3.1-188
3.1.2.3.2	Site Flow System Boundaries and Hydro- geologic Units 3.1-190
3.1.2.3.2.1	Unsaturated Zone Hydrogeologic Units 3.1-190
3.1.2.3.2.2	Saturated Zone Hydrogeologic Units 3.1-192
3.1.2.3.3	Potentiometric Levels, Matric Potentials, and Gradients 3.1-192
3.1.2.3.3.1	Unsaturated Zone Potentials 3.1-192
3.1.2.3.3.2	Saturated Zone Potentials 3.1-194
3.1.2.3.4	Characteristics of Hydrogeologic Units 3.1-196
3.1.2.3.4.1	Unsaturated Zone Hydrologic Units 3.1-196
3.1.2.3.4.2	Saturated Zone Hydrogeologic Units 3.1-199
3.1.2.3.5	Site Groundwater Recharge 3.1-200
3.1.2.3.6	Site Groundwater Discharge 3.1-201
3.1.2.3.7	Age of Site Groundwater 3.1-201
3.1.2.3.8	Site Pathway Analysis 3.1-204
3.1.2.3.9	Local Groundwater Use 3.1-206
3.1.2.3.10	Site Paleohydrology 3.1-207
3.1.3	Geochemical System 3.1-214
3.1.3.1	Regional Geochemistry 3.1-215
3.1.3.2	Site Geochemistry 3.1-215
3.1.3.2.1	Geochemistry of the Site Rock 3.1-215
3.1.3.2.1.1	Geochemistry of the Topopah Spring Member 3.1-216
3.1.3.2.1.1.1	Major Element Composition 3.1-217
3.1.3.2.1.1.2	Primary Phases 3.1-219
3.1.3.2.1.1.3	High-Temperature Secondary Phases 3.1-221
3.1.3.2.1.1.4	Low Temperature Phases 3.1-224
3.1.3.2.1.2	Geochemistry of Calico Hills Formation 3.1-227
3.1.3.2.2	Geochemistry of the Site Groundwater and Gas 3.1-227
3.1.3.2.3	Site Geochemistry Governing Radionuclide Mobility 3.1-227
3.1.4	Climatological and Meteorological Systems 3.1-227
3.1.4.1	Present Climate and Meteorology 3.1-227
3.1.4.1.1	Climate 3.1-228
3.1.4.1.1.1	Scales of Atmospheric Motion and General Climatic Perspective 3.1-228
3.1.4.1.1.1.1	Planetary Scale 3.1-229
3.1.4.1.1.1.2	Large-Scale Atmospheric Features 3.1-229
3.1.4.1.1.1.3	Mesoscale Atmospheric Features 3.1-233
3.1.4.1.1.1.4	Microscale Atmospheric Features 3.1-235
3.1.4.1.1.2	Climatological Parameters 3.1-235

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
3.1.4.1.1.2.1 Temperature	3.1-235
3.1.4.1.1.2.2 Precipitation	3.1-236
3.1.4.1.1.2.3 Atmospheric Moisture	3.1-238
3.1.4.1.1.2.4 Wind Speed and Direction	3.1-238
3.1.4.1.1.2.5 Upper Air Data	3.1-240
3.1.4.1.1.2.5.1 Winds	3.1-240
3.1.4.1.1.2.5.2 Mixing Heights	3.1-241
3.1.4.1.1.2.6 Atmospheric Pressure	3.1-241
3.1.4.1.1.2.7 Insolation (Sunshine)	3.1-243
3.1.4.1.1.2.8 Severe Weather and Obstructions to Visibility	3.1-243
3.1.4.1.1.2.9 Extremes	3.1-245
3.1.4.1.2 Site Meteorological Monitoring Network ...	3.1-246
3.1.4.1.3 Site Meteorology	3.1-249
3.1.4.2 Paleoclimatology	3.1-251
3.1.4.3 Future Climatic Variation	3.1-251
3.1.5 Integrated Natural System Response to the Maximum Design Thermal Loading	3.1-251
3.1.5.1 Response of Geomechanical Subsystem	3.1-251
3.1.5.2 Hydrologic Response to Thermal Loading	3.1-252
3.1.5.3 Response of Geochemical System to Thermal Loading	3.1-252
REFERENCES	3.1-253
3.2 DESCRIPTION OF THE ANTICIPATED PROCESSES AND EVENTS AND UNANTICIPATED PROCESSES AND EVENTS	3.2-1
3.2.0 Introduction	3.2-1
3.2.1 Description of Data Base	3.2-1
3.2.1.1 Natural Processes and Events	3.2-1
3.2.1.1.1 Natural Events During the Pre-Quaternary and Quaternary Periods	3.2-1
3.2.1.1.1.1 Volcanism	3.2-1
3.2.1.1.1.2 Faulting	3.2-1
3.2.1.1.1.3 Seismicity	3.2-1
3.2.1.2 Characteristics of Emplaced Waste	3.2-1
3.2.1.2.1 Expected Thermal Output	3.2-1
3.2.1.2.2 Chemical Characteristics of the Waste Package and Engineered Barrier	3.2-1
3.2.1.2.3 Location and Size of the Emplacement Panels	3.2-1
3.2.1.2.4 Effects from Excavation on the Natural System	3.2-1
3.2.1.2.5 Expected Effects on the Natural System	3.2-1
3.2.1.3 Past Human Activities	3.2-1
3.2.1.3.1 Drilling	3.2-1
3.2.1.3.2 Mining Activities	3.2-1

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
3.2.1.3.3 Ground Water Injection and Withdrawal	3.2-1
3.2.1.3.4 Underground Nuclear Tests	3.2-1
3.2.2 Anticipated Processes and Events and Unanticipated Processes and Events .	3.2-1
3.2.2.1 Natural Processes and Events	3.2-1
3.2.2.1.1 Volcanism	3.2-2
3.2.2.1.2 Faulting	3.2-2
3.2.2.1.3 Seismicity	3.2-2
3.2.2.2 Repository Effects	3.2-2
3.2.2.2.1 Expected Effects of Waste Emplacement on the Natural System	3.2-2
3.2.2.3 Human Activities	3.2-2
3.2.2.3.1 Effects of Human Interference from Exploitation of Natural Resources at the Site	3.2-2
3.2.2.3.2 Underground Nuclear Test	3.2-2
3.2.2.3.3 Controlling Mechanism to Prevent or Mitigate Human Activities	3.2-2
REFERENCES	3.2-3
3.3 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60	3.3-1
3.3.1 Geologic System	3.3-1
3.3.1.1 Favorable Conditions	3.3-2
3.3.1.1.1 Nature and Rates of Tectonic and Geomorphic Processes	3.3-2
3.3.1.1.2 Minimum Depth of 300 Meters	3.3-3
3.3.1.1.3 Low Population Density	3.3-3
3.3.1.2 Potentially Adverse Conditions	3.3-3
3.3.1.2.1 Evidence of Dissolutioning	3.3-4
3.3.1.2.2 Structural Deformation	3.3-4
3.3.1.2.3 Historic Earthquakes	3.3-4
3.3.1.2.4 Correlations of Earthquakes and Tectonic Processes	3.3-4
3.3.1.2.5 More Frequent and Higher Magnitude Earthquakes	3.3-4
3.3.1.2.6 Igneous Activity	3.3-5
3.3.1.2.7 Extreme Erosion	3.3-5
3.3.1.2.8 Naturally Occurring Materials	3.3-6
3.3.1.2.9 Subsurface Mining	3.3-6
3.3.1.2.10 Evidence of Drilling	3.3-6
3.3.1.2.11 Stable Underground Opening	3.3-7
3.3.2 Hydrologic System	3.3-7
3.3.2.1 Favorable Conditions	3.3-8
3.3.2.1.1 Nature and Rates of Hydrogeologic Processes . .	3.3-8

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
3.3.2.1.2 For Disposal in the Saturated Zone	3.3-9
3.3.2.1.3 Pre-Waste-Emplacement Groundwater Travel Time	3.3-9
3.3.2.1.4 Disposal in the Unsaturated Zone	3.3-12
3.3.2.2 Potentially Adverse Conditions	3.3-14
3.3.2.2.1 Potential for Flooding	3.3-14
3.3.2.2.2 Human Activity	3.3-15
3.3.2.2.3 Natural Phenomena	3.3-16
3.3.2.2.4 Structural Deformation	3.3-16
3.3.2.2.5 Changes in Hydrologic Conditions	3.3-16
3.3.2.2.6 Complex Engineering Measures	3.3-16
3.3.2.2.7 Water Table Rise	3.3-17
3.3.2.2.8 Perched Water	3.3-18
3.3.3 Geochemical System	3.3-18
3.3.3.1 Favorable Conditions	3.3-19
3.3.3.1.1 Nature and Rates of Processes	3.3-19
3.3.3.1.2 Geochemical Conditions	3.3-19
3.3.3.1.3 Mineral Assemblages	3.3-19
3.3.3.2 Potentially Adverse Conditions	3.3-20
3.3.3.2.1 Groundwater Conditions	3.3-20
3.3.3.2.2 Geochemical Processes	3.3-20
3.3.3.2.3 Absence of Reducing Conditions	3.3-20
3.3.3.2.4 Gaseous Radionuclide Migration	3.3-20
3.3.4 Climatological and Meteorological Systems	3.3-21
3.3.4.1 Favorable Conditions	3.3-22
3.3.4.2 Potentially Adverse Conditions	3.3-22
3.3.5 Assessment of Compliance with Performance Objective	3.3-22
3.3.5.1 Disturbed Zone	3.3-23
3.3.5.2 Groundwater Travel Time	3.3-23
3.3.6 Effectiveness of Natural Barriers Against the Release of Radioactive Material to the Environment	3.3-23
REFERENCES	3.3-24
4.0 GEOLOGIC REPOSITORY OPERATIONS AREA: PHYSICAL FACILITIES . .	4.0-1
REFERENCES	4.0-2
ACRONYMS AND ABBREVIATIONS	4.0-3
4.1 DESCRIPTION OF THE GROA SSCs	4.1-1
4.1.0 Introduction	4.1-1
4.1.0.1 GROA Mission	4.1-1

TABLE OF CONTENTS (continued)

		Page
4.1.0.2	GROA Description	4.1-1
4.1.0.3	Schedule for Construction and Operation	4.1-2
4.1.0.4	Design Criteria	4.1-2
4.1.0.4.1	Regulatory Requirements	4.1-2
4.1.0.4.2	Derivative Design Criteria	4.1-3
4.1.0.4.3	Site Characteristics	4.1-3
4.1.0.5	Identification and Classification of SSCs	4.1-4
4.1.0.6	SSCs Requiring Research and Development (R&D)	4.1-4
4.1.0.7	Alternative Design Features	4.1-5
4.1.1	Surface Facilities	4.1-5
4.1.1.1	Hot Cell Waste-Handling System, Buildings, and Equipment	4.1-6
4.1.1.2	On-Site Radioactive Waste Management System	4.1-9
4.1.1.3	Fire and Explosion Protection System	4.1-11
4.1.1.4	Emergency Systems	4.1-13
4.1.1.5	Communications Systems	4.1-15
4.1.1.6	Utility Systems	4.1-16
4.1.1.7	Instrumentation and Control Systems	4.1-19
4.1.1.8	On-site Transportation Systems	4.1-21
4.1.1.9	Ventilation Systems	4.1-23
4.1.1.10	Operations Support Systems	4.1-25
4.1.1.10.1	Emplacement Side Operations Support Systems	4.1-26
4.1.1.10.2	Development Side Operations Support Systems	4.1-26
4.1.1.10.2.1	General Development Side Support Facilities Description	4.1-27
4.1.1.10.2.2	Development Side Maintenance Shops	4.1-27
4.1.1.10.2.3	Development Side Supplies Warehouse and Storage Yard	4.1-27
4.1.1.10.2.4	Development Side Worker's Lockers and Showers	4.1-27
4.1.1.10.2.5	Visitors Center	4.1-27
4.1.1.10.2.6	Development Side Offices	4.1-27
4.1.1.10.2.7	Other Development Side Support Facilities	4.1-27
4.1.1.11	Decommissioning System	4.1-27
4.1.1.11.1	Major Facility Decontamination and Decommissioning Description	4.1-29
4.1.1.11.1.1	Waste Handling Building	4.1-29
4.1.1.11.1.2	Waste Treatment Building	4.1-29
4.1.1.11.1.3	Performance Confirmation Building	4.1-29
4.1.1.11.1.4	Emplacement Side Exhaust Ventilation Plant	4.1-29
4.1.1.11.1.5	Decontamination Building	4.1-29

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
4.1.1.11.2 Other Equipment Decontamination and Decommissioning Description	4.1-29
4.1.1.11.3 Other Systems Decontamination and Decommissioning Description	4.1-30
4.1.1.11.4 Other Facilities Decontamination and Decommissioning Description	4.1-30
4.1.1.11.5 Decommissioning Operations Adversely Impacting Waste Isolation	4.1-30
4.1.1.12 Other Surface Systems	4.1-30
4.1.2 Shafts and Ramps	4.1-31
4.1.2.1 Waste Ramp	4.1-31
4.1.2.1.1 Waste Ramp Design Description	4.1-32
4.1.2.1.1.1 Design Bases	4.1-32
4.1.2.1.1.2 Geologic Stratigraphy	4.1-32
4.1.2.1.1.3 Ramp Portal Layout and Arrangement	4.1-32
4.1.2.1.1.4 Ramp Portal Lining and Support	4.1-32
4.1.2.1.1.5 Ramp Layout and Arrangement	4.1-32
4.1.2.1.1.6 Ramp Lining and Support	4.1-32
4.1.2.1.1.7 Ramp Cross Sections	4.1-32
4.1.2.1.1.8 Ramp Portal Drainage	4.1-33
4.1.2.1.1.9 Ramp Drainage	4.1-33
4.1.2.1.2 Waste Ramp Operating Description	4.1-33
4.1.2.1.2.1 Waste Description	4.1-33
4.1.2.1.2.2 General Hauling Arrangements	4.1-33
4.1.2.1.2.3 Ventilation	4.1-33
4.1.2.1.2.4 Safety Measures	4.1-33
4.1.2.1.2.5 Operations Schedules	4.1-34
4.1.2.1.2.6 Maintenance Schedules	4.1-34
4.1.2.1.2.7 Instrumentation and Control Systems	4.1-34
4.1.2.1.3 Waste Ramp Seals	4.1-34
4.1.2.1.3.1 Operational Seals	4.1-34
4.1.2.1.3.2 Post-Closure Seals	4.1-34
4.1.2.2 Muck Shaft or Ramp	4.1-34
4.1.2.2.1 Muck Ramp Design Description	4.1-34
4.1.2.2.1.1 Design Bases	4.1-34
4.1.2.2.1.2 Geologic Stratigraphy	4.1-34
4.1.2.2.1.3 Ramp Portal Layout and Arrangement	4.1-35
4.1.2.2.1.4 Ramp Portal Lining and Support	4.1-35
4.1.2.2.1.5 Ramp Layout and Arrangement	4.1-35
4.1.2.2.1.6 Ramp Lining and Support	4.1-35
4.1.2.2.1.7 Ramp Cross Sections	4.1-35
4.1.2.2.1.8 [Ramp Portal] Drainage	4.1-35
4.1.2.2.1.9 [Ramp] Drainage	4.1-35

Date: 03/31/95

TABLE OF CONTENTS (continued)

		Page
4.1.2.2.2	Muck [Ramp] Operating Description	4.1-35
4.1.2.2.2.1	Waste Description	4.1-36
4.1.2.2.2.2	General Hauling Arrangements	4.1-36
4.1.2.2.2.3	Ventilation	4.1-36
4.1.2.2.2.4	Safety Measures	4.1-36
4.1.2.2.2.5	Operations Schedules	4.1-36
4.1.2.2.2.6	Maintenance Schedules	4.1-36
4.1.2.2.2.7	Instrumentation and Control Systems	4.1-36
4.1.2.2.3	Muck Ramp Seals	4.1-37
4.1.2.2.3.1	Operational Seals	4.1-37
4.1.2.2.3.2	Post-Closure Seals	4.1-37
4.1.2.3	Ventilation Intake Shafts	4.1-37
4.1.2.3.1	Ventilation Intake Shaft Design Description	4.1-37
4.1.2.3.1.1	Design Bases	4.1-37
4.1.2.3.1.2	Geologic Stratigraphy	4.1-37
4.1.2.3.1.3	Shaft Collar Layout and Arrangement	4.1-37
4.1.2.3.1.4	Shaft Collar Lining and Support	4.1-37
4.1.2.3.1.5	Shaft Layout and Arrangement	4.1-38
4.1.2.3.1.6	Shaft Lining and Support	4.1-38
4.1.2.3.1.7	Shaft Cross Sections	4.1-38
4.1.2.3.1.8	Shaft Collar Drainage	4.1-38
4.1.2.3.1.9	Shaft Drainage	4.1-38
4.1.2.3.2	Ventilation Intake Shaft Operating Description	4.1-38
4.1.2.3.2.1	Ventilation	4.1-38
4.1.2.3.2.2	Maintenance Schedules	4.1-38
4.1.2.3.2.3	Instrumentation and Control Systems	4.1-39
4.1.2.3.3	Ventilation Intake Shaft Seals	4.1-39
4.1.2.3.3.1	Operational Seals	4.1-39
4.1.2.3.3.2	Post-Closure Seals	4.1-39
4.1.2.4	Ventilation Exhaust Shafts	4.1-39
4.1.2.4.1	Ventilation Exhaust Shafts - Emplacement Side	4.1-39
4.1.2.4.1.1	Emplacement Side Exhaust Shaft Design Description	4.1-39
4.1.2.4.1.1.1	Design Bases	4.1-39
4.1.2.4.1.1.2	Geologic Stratigraphy	4.1-39
4.1.2.4.1.1.3	Shaft Collar Layout and Arrangement	4.1-39
4.1.2.4.1.1.4	Shaft Collar Lining and Support	4.1-40
4.1.2.4.1.1.5	Shaft Layout and Arrangement	4.1-40
4.1.2.4.1.1.6	Shaft Lining and Support	4.1-40
4.1.2.4.1.1.7	Shaft Cross Sections	4.1-40
4.1.2.4.1.1.8	Shaft Collar Drainage	4.1-40

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
4.1.2.4.1.1.9 Shaft Drainage	4.1-41
4.1.2.4.1.2 Emplacement Side Exhaust Shaft Operating	
Description	4.1-41
4.1.2.4.1.2.1 Ventilation	4.1-41
4.1.2.4.1.2.2 HEPA and Exhaust Filters	4.1-41
4.1.2.4.1.2.3 Safety Measures	4.1-41
4.1.2.4.1.2.4 Maintenance Schedules	4.1-42
4.1.2.4.1.2.5 Instrumentation and Control Systems	4.1-42
4.1.2.4.1.3 Emplacement Side Exhaust Shaft Seals	4.1-42
4.1.2.4.1.3.1 Operational Seals	4.1-42
4.1.2.4.1.3.2 Post-Closure Seals	4.1-42
4.1.2.4.2 Ventilation Exhaust Shafts - Development	
Side	4.1-42
4.1.2.4.2.1 Development Side Exhaust Shaft Design	
Description	4.1-42
4.1.2.4.2.1.1 Design Bases	4.1-42
4.1.2.4.2.1.2 Geologic Stratigraphy	4.1-42
4.1.2.4.2.1.3 Shaft Collar Layout and Arrangement	4.1-42
4.1.2.4.2.1.4 Shaft Collar Lining and Support	4.1-43
4.1.2.4.2.1.5 Shaft Layout and Arrangement	4.1-43
4.1.2.4.2.1.6 Shaft Lining and Support	4.1-43
4.1.2.4.2.1.7 Shaft Cross Sections	4.1-43
4.1.2.4.2.1.8 Shaft Collar Drainage	4.1-43
4.1.2.4.2.1.9 Shaft Drainage	4.1-44
4.1.2.4.2.2 Development Side Exhaust Shaft Operating	
Description	4.1-44
4.1.2.4.2.2.1 Ventilation	4.1-44
4.1.2.4.2.2.2 HEPA and Exhaust Filters	4.1-44
4.1.2.4.2.2.3 Safety Measures	4.1-44
4.1.2.4.2.2.4 Maintenance Schedules	4.1-44
4.1.2.4.2.2.5 Instrumentation and Control Systems	4.1-44
4.1.2.4.2.3 Development Side Exhaust Shaft Seals	4.1-44
4.1.2.4.2.3.1 Operational Seals	4.1-44
4.1.2.4.2.3.2 Post-Closure Seals	4.1-45
4.1.2.5 Personnel and Material Shafts	4.1-45
4.1.2.5.1 Personnel and Materials Shaft Design	
Description	4.1-45
4.1.2.5.1.1 Design Bases	4.1-45
4.1.2.5.1.2 Geologic Stratigraphy	4.1-45
4.1.2.5.1.3 Shaft Collar Layout and Arrangement	4.1-45
4.1.2.5.1.4 Shaft Collar Lining and Support	4.1-45
4.1.2.5.1.5 Shaft Layout and Arrangement	4.1-45
4.1.2.5.1.6 Shaft Lining and Support	4.1-45

Date: 03/31/95

TABLE OF CONTENTS (continued)

		Page
4.1.2.5.1.7	Shaft Cross Sections	4.1-46
4.1.2.5.1.8	Shaft Collar Drainage	4.1-46
4.1.2.5.1.9	Shaft Drainage	4.1-46
4.1.2.5.2	Personnel and Materials Shaft Operating	
	Description	4.1-46
4.1.2.5.2.1	Hoisting Equipment	4.1-46
4.1.2.5.2.2	Ventilation	4.1-47
4.1.2.5.2.3	Safety Measures	4.1-47
4.1.2.5.2.4	Operations Schedules	4.1-47
4.1.2.5.2.5	Maintenance Schedules	4.1-47
4.1.2.5.2.6	Instrumentation and Control Systems	4.1-47
4.1.2.5.3	Personnel and Materials Shaft Seals	4.1-47
4.1.2.5.3.1	Operational Seals	4.1-47
4.1.2.5.3.2	Post-Closure Seals	4.1-47
4.1.2.6	Decommissioning System	4.1-48
4.1.2.6.1	Operational Seals	4.1-48
4.1.2.6.2	Post-Closure Seals	4.1-48
4.1.2.6.2.1	Shaft Backfilling System	4.1-48
4.1.2.6.2.2	Ramp Backfilling System	4.1-48
4.1.2.6.2.3	Shaft Sealing System	4.1-48
4.1.2.6.2.4	Ramp Sealing System	4.1-48
4.1.2.6.2.5	Other Plugs and Bulkheads	4.1-48
4.1.2.6.3	Materials Selection Bases	4.1-48
4.1.2.6.3.1	Backfill Materials	4.1-49
4.1.2.6.3.2	Seal Materials	4.1-49
4.1.2.6.3.3	Other Plugs and Bulkheads	4.1-49
4.1.2.6.4	Installation Methods and Equipment	
	Description	4.1-49
4.1.2.6.4.1	Shaft Backfilling	4.1-49
4.1.2.6.4.2	Ramp Backfilling	4.1-49
4.1.2.6.4.3	Shaft Sealing	4.1-50
4.1.2.6.4.4	Ramp Sealing	4.1-50
4.1.2.6.4.5	Other Plugs and Bulkheads	4.1-50
4.1.2.7	Other Shaft or Ramp Systems	4.1-51
4.1.3	Underground Facility	4.1-51
4.1.3.1	Excavation and Ground Support Systems	4.1-52
4.1.3.1.1	Excavation Systems	4.1-52
4.1.3.1.1.1	Design Bases	4.1-52
4.1.3.1.1.2	Primary Methods - Designs and Operating	
	Features	4.1-53
4.1.3.1.1.3	Secondary Methods - Designs and Operating	
	Features	4.1-53
4.1.3.1.2	Ground Control	4.1-53

TABLE OF CONTENTS (continued)

	Page
4.1.3.1.2.1 Design Bases	4.1-53
4.1.3.1.2.2 Ground Support Design	4.1-54
4.1.3.2 Muck Handling System	4.1-54
4.1.3.3 Ventilation System	4.1-54
4.1.3.3.1 General Underground Descriptions	4.1-55
4.1.3.3.1.1 Design Bases	4.1-55
4.1.3.3.1.2 Separate Ventilation Systems	4.1-55
4.1.3.3.1.3 Ventilation Control Devices	4.1-55
4.1.3.3.1.4 Fan Facilities	4.1-55
4.1.3.3.1.5 Intake Heating and Cooling Systems	4.1-56
4.1.3.3.1.6 Operations & Maintenance	4.1-56
4.1.3.3.1.7 Monitoring Systems	4.1-56
4.1.3.3.1.8 Ventilation For Retrieval	4.1-56
4.1.3.3.1.9 General Flowpaths	4.1-56
4.1.3.3.2 Development Ventilation System	4.1-56
4.1.3.3.2.1 Flowpath Description	4.1-56
4.1.3.3.2.2 Air Quantity Determination	4.1-56
4.1.3.3.2.3 Quantity/Pressure/Power Projection	4.1-57
4.1.3.3.3 Emplacement Ventilation System	4.1-57
4.1.3.3.3.1 Flowpath Description	4.1-57
4.1.3.3.3.2 Air Quantity Determination	4.1-57
4.1.3.3.3.3 Quantity/Pressure/Power Projection	4.1-57
4.1.3.4 Waste Emplacement System	4.1-57
4.1.3.4.1 Waste Emplacement Concept and Considerations	4.1-58
4.1.3.4.1.1 Waste and Waste Package Characteristics	4.1-58
4.1.3.4.1.2 General Emplacement Concept	4.1-58
4.1.3.4.1.3 Waste Handling Equipment	4.1-58
4.1.3.4.2 Excavation and Ground Support of Emplacement Area	4.1-59
4.1.3.4.2.1 Design Bases	4.1-59
4.1.3.4.2.2 Ground Support Design	4.1-59
4.1.3.5 Waste Retrieval System	4.1-59
4.1.3.6 Emergency Systems	4.1-59
4.1.3.7 Communication System	4.1-60
4.1.3.8 Operations Support System	4.1-60
4.1.3.9 Decommissioning System	4.1-60
4.1.3.10 Other Underground Systems	4.1-61
4.1.4 Radiation Protection	4.1-61
4.1.4.1 Layout Drawings of Radiological Areas and Facilities	4.1-62
4.1.4.2 ALARA Design Consideration	4.1-62
4.1.4.2.1 ALARA Design Principles for GROA Systems	4.1-64

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
4.1.4.2.2 ALARA Experience from Past Applications . .	4.1-64
4.1.4.2.3 ALARA Design Considerations	4.1-64
4.1.4.2.4 Ventilation and Off-gas Treatment Systems . .	4.1-65
4.1.4.3 Characterization of Shielding	4.1-65
4.1.4.3.1 Radiation Sources	4.1-65
4.1.4.3.1.1 Characterization of Sources	4.1-65
4.1.4.3.1.2 Airborne Radioactive Material Sources	4.1-66
4.1.4.3.2 Shielding	4.1-68
4.1.4.4 Radiological Monitoring Instrumentation	4.1-70
4.1.5 Interface of SSCs	4.1-71
REFERENCES	4.1-72
4.2 ASSESSMENT OF COMPLIANCE FOR SURFACE FACILITIES	4.2-1
4.2.0 Introduction	4.2-1
4.2.0.1 Compliance with 10 CFR 60 Requirements	4.2-1
4.2.0.2 Accident Analyses	4.2-2
4.2.0.3 Basis for Identification of SSCs Important to Safety	4.2-2
4.2.0.4 Description of Models	4.2-2
4.2.1 Applicable Requirements and Criteria	4.2-3
4.2.1.1 Airborne Radioactive Materials	4.2-4
4.2.1.2 Occupancy Time [INN 4.2.1.2-1]	4.2-4
4.2.1.3 Shielding [INN 4.2.1.3-1]	4.2-5
4.2.1.4 Contamination Control [INN 4.2.1.4-1]	4.2-5
4.2.1.5 Access Control [INN 4.2.1.5-1]	4.2-5
4.2.1.6 Radiation Alarm Systems [INN 4.2.1.6-1]	4.2-5
4.2.1.7 Dose Rates in Restricted Areas	4.2-5
4.2.1.8 ALARA	4.2-6
4.2.1.9 Natural Phenomena and Environmental Conditions	4.2-6
4.2.1.10 Dynamic Effects	4.2-6
4.2.1.11 Performance During and After Fires and Explosions	4.2-6
4.2.1.12 Noncombustible and Heat-resistant Materials	4.2-7
4.2.1.13 Fire and Explosion Protection Systems	4.2-7
4.2.1.14 Adverse Safety Effects of Fire and Explosion System Operation or Failure	4.2-7
4.2.1.15 Control of Radioactive Materials	4.2-7
4.2.1.16 Response to Emergency Conditions [INN 4.2.1.16-1]	4.2-7
4.2.1.17 Utility System Performance During Normal and Accident Conditions	4.2-8
4.2.1.18 Utility System Redundancy	4.2-8
4.2.1.19 Emergency Power [INN 4.2.1.19-1]	4.2-8
4.2.1.20 SSC Operability Verification	4.2-8
4.2.1.21 Criticality	4.2-8

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
4.2.1.22 Instrumentation	4.2-9
4.2.1.23 Worker Protection	4.2-9
4.2.1.24 Hoists [INN 4.2.1.24-1]	4.2-9
4.2.1.25 Handling and Storage of Wastes	4.2-9
4.2.1.26 Ventilation Systems [INN 4.2.1.26-1]	4.2-9
4.2.1.27 Radioactive Effluents	4.2-10
4.2.1.28 Effluent Monitoring	4.2-10
4.2.1.29 Radioactive Waste Treatment	4.2-10
4.2.2 System Specific Compliance with Applicable Requirements and Criteria	4.2-10
4.2.2.1 Hot Cell	4.2-11
4.2.2.2 Onsite Radioactive	4.2-11
4.2.2.3 Fire and Explosion Protection Systems	4.2-11
4.2.2.4 Emergency Systems	4.2-11
4.2.2.5 Communication Systems	4.2-11
4.2.2.6 Utility Systems	4.2-11
4.2.2.7 Instrumentation and Controls	4.2-11
4.2.2.8 Onsite Transportation System	4.2-11
4.2.2.9 Ventilation Systems	4.2-11
4.2.2.10 Operations Support Systems	4.2-11
4.2.2.11 Decommissioning System	4.2-12
4.2.2.12 Other Surface Systems	4.2-12
REFERENCES	4.2-13
4.3 ASSESSMENT OF COMPLIANCE FOR SHAFTS OR RAMPS	4.3-1
4.3.0 Introduction	4.3-1
4.3.0.1 Compliance with 10 CFR 60 Requirements	4.3-1
4.3.0.2 Accident Analyses	4.3-2
4.3.0.3 Basis for Identification of SSCs Important to Safety	4.3-2
4.3.0.4 Description of Models	4.3-2
4.3.1 Applicable Requirements and Criteria	4.3-3
4.3.1.1 Airborne Radioactive Materials	4.3-4
4.3.1.2 Contamination Control	4.3-5
4.3.1.3 Dose Rates in Restricted Areas	4.3-5
4.3.1.4 Natural Phenomena and Environmental Conditions	4.3-5
4.3.1.5 Dynamic Effects	4.3-5
4.3.1.6 Performance During and After Fires and Explosions	4.3-6
4.3.1.7 Noncombustible and Heat-resistant Materials	4.3-6
4.3.1.8 Fire and Explosion Protection Systems	4.3-6
4.3.1.9 Adverse Safety Effects of Fire and Explosion System Operation or Failure	4.3-6
4.3.1.10 Control of Radioactive Materials	4.3-6

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
4.3.1.11 Utility System Performance During Normal and Accident Conditions	4.3-6
4.3.1.12 Utility System Redundancy	4.3-6
4.3.1.13 Emergency Power	4.3-7
4.3.1.14 SSC Operability Verification	4.3-7
4.3.1.15 Criticality	4.3-7
4.3.1.16 Instrumentation	4.3-7
4.3.1.17 Worker Protection	4.3-7
4.3.1.18 Shaft and Borehole Seals	4.3-8
4.3.1.19 Seal Materials and Placement Methods	4.3-8
4.3.2 System Specific Compliance with Applicable Requirements and Criteria ..	4.3-8
4.3.2.1 Waste Shaft or Ramp	4.3-9
4.3.2.2 Muck Shaft or Ramp	4.3-9
4.3.2.3 Ventilation Intake Shafts	4.3-9
4.3.2.4 Ventilation Exhaust Shafts	4.3-9
4.3.2.5 Personnel and Materials Shafts	4.3-9
4.3.2.6 Decommissioning System	4.3-9
4.3.2.7 Other Shaft or Ramp Systems	4.3-9
REFERENCES	4.3-10
4.4 ASSESSMENT OF COMPLIANCE FOR UNDERGROUND FACILITIES	4.4-1
4.4.0 Introduction	4.4-1
4.4.0.1 Compliance with 10 CFR 60 Requirements	4.4-1
4.4.0.2 Accident Analyses	4.4-2
4.4.0.3 Basis for Identification of SSCs Important to Safety	4.4-2
4.4.0.4 Description of Models	4.4-2
4.4.1 Applicable Requirements and Criteria	4.4-3
4.4.1.1 Airborne Radioactive Materials	4.4-4
4.4.1.2 Personnel Occupancy Time	4.4-5
4.4.1.3 Shielding	4.4-5
4.4.1.4 Contamination Control	4.4-5
4.4.1.5 Access Control	4.4-5
4.4.1.6 Radiation Alarm Systems	4.4-5
4.4.1.7 Dose Rates in Restricted Areas	4.4-6
4.4.1.8 ALARA	4.4-6
4.4.1.9 Natural Phenomena and Environmental Conditions	4.4-6
4.4.1.10 Dynamic Effects	4.4-6
4.4.1.11 Performance During and After Fires and Explosions	4.4-7
4.4.1.12 Noncombustible and Heat-resistant Materials	4.4-7
4.4.1.13 Fire and Explosion Protection Systems	4.4-7
4.4.1.14 Adverse Safety Effects of Fire and Explosion System Operation or Failure	4.4-7

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
4.4.1.15 Control Of Radioactive Materials	4.4-7
4.4.1.16 Use of Offsite Services	4.4-7
4.4.1.17 Utility System Performance During Normal and Accident Conditions	4.4-8
4.4.1.18 Utility System Redundancy	4.4-8
4.4.1.19 Emergency Power	4.4-8
4.4.1.20 SSC Operability Verification	4.4-8
4.4.1.21 Criticality	4.4-8
4.4.1.22 Instrumentation	4.4-9
4.4.1.23 Worker Protection	4.4-9
4.4.1.24 Orientation and Depth	4.4-9
4.4.1.25 Disruptive Events	4.4-9
4.4.1.26 Flexibility	4.4-9
4.4.1.27 Retrieval of Waste	4.4-10
4.4.1.28 Water or Gas Intrusion	4.4-10
4.4.1.29 Openings	4.4-10
4.4.1.30 Structural Integrity of Openings	4.4-10
4.4.1.31 Excavation Methods	4.4-10
4.4.1.32 Ventilation Systems	4.4-10
4.4.1.33 Engineered Barriers	4.4-11
4.4.1.34 Thermal and Thermochemical Response	4.4-11
4.4.2 System-Specific Compliance with Applicable Requirements and Criteria .	4.4-11
4.4.2.1 Excavation and Ground Support Systems	4.4-12
4.4.2.2 Muck Handling System	4.4-12
4.4.2.3 Ventilation System	4.4-12
4.4.2.4 Waste Emplacement System	4.4-12
4.4.2.5 Waste Retrieval System	4.4-12
4.4.2.6 Emergency Systems	4.4-12
4.4.2.7 Communication System	4.4-12
4.4.2.8 Operations Support System	4.4-12
4.4.2.9 Decommissioning System	4.4-12
4.4.2.10 Other Underground Systems	4.4-13
REFERENCES	4.4-14
4.5 INTEGRATED GEOLOGIC REPOSITORY OPERATIONS AREA	
COMPLIANCE WITH PERFORMANCE OBJECTIVES	4.5-1
4.5.0 Introduction	4.5-1
4.5.0.1 Compliance with 10 CFR 60 Performance Objectives	4.5-1
4.5.0.2 Accident Analyses and Prevention	4.5-2
4.5.0.3 Basis for Identification of SSCs Importance to Safety	4.5-2
4.5.0.4 Description of Models	4.5-2

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
4.5.1 Protection Against Radiation Exposures and Releases of Radioactive Material to Unrestricted Areas	4.5-3
4.5.1.1 Radioactivity in Effluents to Unrestricted Areas	4.5-4
4.5.1.2 Compliance with Permissible Levels of Radiation in Unrestricted Areas	4.5-5
4.5.1.3 Compliance with Environmental Radiation Protection Standards	4.5-6
4.5.1.4 Compliance with ALARA Principles	4.5-6
4.5.2 Retrievability of Waste	4.5-6
REFERENCES	4.5-8
5.0 ENGINEERED BARRIER SYSTEMS	5.0-1
REFERENCES	5.0-3
ACRONYMS AND ABBREVIATIONS	5.0-4
5.1 DESCRIPTION OF ENGINEERED SYSTEMS AND COMPONENTS THAT PROVIDE A BARRIER BETWEEN THE HIGH-LEVEL WASTE AND THE GEOLOGIC SETTING	5.1-1
5.1.1 WP	5.1-1
5.1.1.1 MPC	5.1-1
5.1.1.2 Disposal container for SNF in MPCs	5.1-2
5.1.1.3 Disposal container for Uncanistered SNF	5.1-2
5.1.1.4 Disposal container for Glass HLW	5.1-3
5.1.1.5 Packing Materials	5.1-3
5.1.2 Waste Form	5.1-4
5.1.2.1 Waste Forms Descriptions and Sources	5.1-4
5.1.2.1.1 SNF	5.1-4
5.1.2.1.2 HLW Glass	5.1-5
5.1.2.1.3 DOE-Owned Spent Nuclear Fuel	5.1-6
5.1.2.2 Quantity of Waste to be Emplaced	5.1-6
5.1.2.3 Waste Form Acceptance and Handling	5.1-6
5.1.3 Underground Facility Design	5.1-7
5.1.3.1 Invert Materials	5.1-7
5.1.3.2 Backfill Materials	5.1-7
5.1.3.3 Waste Emplacement Openings	5.1-8
5.1.4 EBS/WP Emplacement Environment	5.1-8
5.1.4.1 Pre-Emplacement Environment	5.1-8
5.1.4.2 Postemplacement Environment	5.1-8

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
5.1.5 Underground Operations Radiation Protection	5.1-10
REFERENCES	5.1-11
5.2 ASSESSMENT OF COMPLIANCE WITH 10 CFR 60	5.2-1
5.2.1 Assessment of Compliance for Particular Barriers	5.2-2
5.2.1.1 WP Design Requirements	5.2-2
5.2.1.1.1 Compatibility of Design	5.2-2
5.2.1.1.2 Degradation Mechanisms	5.2-2
5.2.1.1.2.1 Solubility	5.2-3
5.2.1.1.2.2 Oxidation/Reduction Reactions	5.2-3
5.2.1.1.2.3 Corrosion	5.2-4
5.2.1.1.2.4 Hydriding	5.2-5
5.2.1.1.2.5 Gas Generation	5.2-5
5.2.1.1.2.6 Thermal Effects	5.2-5
5.2.1.1.2.7 Mechanical Strength	5.2-5
5.2.1.1.2.8 Mechanical Stress	5.2-6
5.2.1.1.2.9 Radiolysis	5.2-6
5.2.1.1.2.10 Radiation Damage	5.2-6
5.2.1.1.2.11 Radionuclide Retardation	5.2-7
5.2.1.1.2.12 Leaching	5.2-7
5.2.1.1.2.13 Fire and Explosion Hazards	5.2-7
5.2.1.1.2.14 Thermal Loads	5.2-7
5.2.1.1.2.15 Synergistic Interactions	5.2-8
5.2.1.1.3 Materials, Handling, and Identification	5.2-8
5.2.1.2 Waste Form	5.2-8
5.2.1.3 Underground Facility	5.2-9
5.2.2 Assessment of Compliance with Performance Objectives	5.2-10
5.2.2.1 Containment	5.2-10
5.2.2.2 Release Rate	5.2-11
5.2.2.3 Criticality Control	5.2-11
5.2.2.3.1 Operations Phase	5.2-12
5.2.2.3.2 SCC Phase	5.2-13
5.2.2.3.3 Isolation Phase	5.2-13
5.2.3 Radiation Protection	5.2-13
REFERENCES	5.2-14
6.0 OVERALL SYSTEM PERFORMANCE ASSESSMENT	6.0-1
REFERENCES	6.0-7
ACRONYMS AND ABBREVIATIONS	6.0-9

XXX

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
6.1 BASIC APPROACH	6.1-1
6.1.1 Conceptual Background for the Assessment of Overall System Performance	6.1-1
6.1.2 Mathematical Background for the Assessment of Overall System Performance	6.1-4
REFERENCES	6.1-6
6.2 SYSTEM DESCRIPTION	6.2-1
6.2.1 Conceptual Models	6.2-1
6.2.2 Potentially Disruptive Processes and Events	6.2-16
6.2.3 Undisturbed Performance Processes and Events	6.2-18
REFERENCES	6.2-20
6.3 ASSESSMENT OF COMPLIANCE: CUMULATIVE RELEASE OF RADIOACTIVE MATERIALS	6.3-1
6.3.1 Screening of Processes and Events	6.3-2
6.3.1.1 Screening Criteria	6.3-2
6.3.1.2 Selected Processes and Events	6.3-2
6.3.1.3 Justification for Elimination of Processes and Events	6.3-6
6.3.2 Scenario Development and Screening	6.3-7
6.3.2.1 Scenario Development - Undisturbed Conditions	6.3-7
6.3.2.2 Screening of Scenarios	6.3-9
6.3.3 Consequence Analysis: Estimates of Cumulative Releases	6.3-10
6.3.3.1 Repository Performance Results	6.3-10
6.3.3.2 Cumulative Releases	6.3-10
6.3.3.3 Methods Used for Cumulative Releases	6.3-17
6.3.4 Probability Estimates	6.3-18
6.3.4.1 Probability of Occurrence of Processes and Events	6.3-18
6.3.4.2 Probability of Occurrence of Scenarios	6.3-20
6.3.4.3 Method of Probability Estimation	6.3-20
6.3.4.4 Probabilities of Transient Phenomena	6.3-20
6.3.4.5 Uncertainty in Probability Estimation	6.3-20
6.3.4.6 Additional Discussion on Probability Estimation	6.3-20
6.3.5 Compliance Assessment for Cumulative Releases	6.3-21
6.3.5.1 Demonstration of Compliance with 10 CFR 60.112	6.3-21
6.3.5.2 Method of CCDF Formulation	6.3-21
6.3.5.3 Composite CCDF for Yucca Mountain	6.3-21
6.3.5.4 Uncertainties in Development of the CCDF	6.3-21
6.3.5.5 Alternative Representations of the CCDF	6.3-21

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
6.3.6 Model and Code Verification and Validation	6.3-21
REFERENCES	6.3-23
6.4 ASSESSMENT OF COMPLIANCE: UNDISTURBED PERFORMANCE	6.4-1
6.4.1 Individual Protection Requirements	6.4-1
6.4.2 Groundwater Protection Requirements	6.4-6
6.4.3 Code Verification and Model Validation	6.4-6
REFERENCES	6.4-7
7.0 CONDUCT OF REPOSITORY OPERATIONS	7.0-1
7.0.1 Waste Handling	7.0-1
7.0.1.1 Waste Receipt	7.0-1
7.0.1.2 Waste Preparation	7.0-2
7.0.1.3 Waste Package Transfer to Underground	7.0-3
7.0.1.4 Waste Package Emplacement	7.0-4
7.0.1.5 Waste Package Retrieval	7.0-4
7.0.2 Subsurface Development	7.0-4
7.0.2.1 Underground Openings Construction	7.0-5
7.0.2.2 Excavated Rock Handling and Processing	7.0-5
7.0.2.3 Excavated Rock Storage and Disposal	7.0-5
7.0.3 Performance Evaluation	7.0-5
7.0.3.1 Performance Confirmation	7.0-6
7.0.3.1.1 In Situ Performance Monitoring	7.0-6
7.0.3.1.2 Laboratory and Field Tests	7.0-6
7.0.3.1.3 In Situ Experiments	7.0-7
7.0.3.1.4 Appropriate Action	7.0-8
7.0.3.2 Laboratory and Field Tests	7.0-8
7.0.3.2.1 Performance Assessment Models	7.0-8
7.0.3.2.2 System Performance	7.0-8
7.0.3.2.3 System Compliance	7.0-8
7.0.3.3 Performance Assessment	7.0-9
7.0.4 Support Operations	7.0-9
7.0.4.1 Provide Utilities and Services	7.0-9
7.0.4.2 Provide Protective Services	7.0-10
7.0.4.3 Administer General Support Services	7.0-10
7.0.4.4 Process Site-Generated Waste	7.0-11
7.0.4.5 Maintain Operating Facilities	7.0-11
7.0.4.6 Administer Quality Assurance (QA)	7.0-11

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
7.0.5 Closure	7.0-12
7.0.5.1 Subsurface Closure	7.0-12
7.0.5.2 Surface Decommissioning	7.0-12
7.0.5.3 Institutional Barrier Establishment	7.0-13
REFERENCES	7.0-14
ACRONYMS AND ABBREVIATIONS	7.0-15
7.1 MAINTENANCE	7.1-1
7.1.1 Surface Facilities	7.1-1
7.1.2 Shafts and Ramps	7.1-1
7.1.3 Subsurface Facilities	7.1-1
REFERENCES	7.1-3
7.2 RADIATION PROTECTION	7.2-1
7.2.1 Organization	7.2-1
7.2.1.1 Repository Manager	7.2-3
7.2.1.2 Radiation Protection Manager	7.2-3
7.2.2 Facilities, Instrumentation, and Equipment	7.2-4
7.2.2.1 Facilities	7.2-5
7.2.2.1.1 Access Control	7.2-6
7.2.2.1.2 Protective Clothing	7.2-7
7.2.2.2 Portable and Laboratory Equipment and Instrumentation	7.2-7
7.2.2.2.1 Laboratory Equipment	7.2-8
7.2.2.2.2 Portable Radiation Monitoring Instruments and Equipment	7.2-8
7.2.2.2.3 Personal Monitoring Equipment	7.2-8
7.2.2.2.4 Respiratory Protection Equipment	7.2-9
7.2.2.2.5 Instrument Calibration and Operational Checks	7.2-10
7.2.3 Procedures	7.2-10
7.2.3.1 Radiation Surveys	7.2-11
7.2.3.2 Radiation Work Permits	7.2-12
7.2.3.3 Personnel Dosimetry and Exposure Records	7.2-12
7.2.3.4 Decontamination of Surface Facilities	7.2-15
7.2.3.5 Radioactive Material Handling	7.2-15
7.2.3.6 Respiratory Protection	7.2-16
7.2.3.7 ALARA Procedures	7.2-17
7.2.3.7.1 Design Considerations	7.2-17
7.2.3.7.2 ALARA Operational Considerations	7.2-17

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
7.2.4 Effluent Monitoring Programs	7.2-18
7.2.4.1 Gaseous and Particulate Monitoring System	7.2-18
7.2.4.2 Liquid Effluent Monitoring System	7.2-19
7.2.4.3 Solid Waste Monitoring	7.2-19
7.2.4.4 Plans for Maintaining Continuing Analysis Integrity	7.2-19
7.2.5 Environmental Monitoring Program	7.2-20
7.2.5.1 Critical Pathways	7.2-20
7.2.5.2 Pre-Operational Radiological Monitoring Program	7.2-20
7.2.5.3 Operational Radiological Monitoring Program	7.2-21
7.2.5.4 Expected GROA Contributions to Radioactivity Levels	7.2-21
7.2.5.5 Operational Meteorological Data Collection	7.2-21
REFERENCES	7.2-22
7.3 ORGANIZATIONAL STRUCTURE, MANAGEMENT, AND ADMINISTRATIVE CONTROLS	7.3-1
7.3.1 Organization	7.3-1
7.3.1.1 Organization for Construction and Design	7.3-1
7.3.1.2 Organization for Operations	7.3-1
7.3.1.3 Organization for Technical Support	7.3-2
7.3.2 Personnel Functions, Responsibilities, and Authorities	7.3-2
7.3.2.1 Repository Manager	7.3-2
7.3.2.2 Operations Manager	7.3-2
7.3.2.3 Radiation Protection Manager	7.3-2
7.3.2.4 Performance Manager	7.3-3
7.3.2.5 Compliance Manager	7.3-3
7.3.2.6 Maintenance Manager	7.3-3
7.3.2.7 Repository Services Manager	7.3-3
7.3.3 Personnel Qualification Requirements	7.3-3
7.3.3.1 Repository Manager	7.3-4
7.3.3.2 Operations Manager	7.3-4
7.3.3.3 Radiation Protection Manager	7.3-4
7.3.3.4 Performance Manager	7.3-4
7.3.3.5 Compliance Manager	7.3-4
7.3.3.6 Maintenance Manager	7.3-4
7.3.3.7 Repository Services Manager	7.3-4
REFERENCES	7.3-5
7.4 PROCEDURE DEVELOPMENT	7.4-1
7.4.0 Introduction	7.4-1
7.4.1 Program For Development Of GROA Operations Procedures	7.4-1
7.4.1.1 Program Introduction	7.4-1

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
7.4.1.2 Guidelines for Procedure Preparation	7.4-1
7.4.1.3 Procedure Review, Validation/Verification and Approval	7.4-1
7.4.1.4 Procedure Amendment Process	7.4-1
7.4.2 GROA Surface Facilities Operations Procedures	7.4-1
7.4.2.1 Normal Operating Procedures	7.4-1
7.4.2.2 Emergency Procedures	7.4-1
7.4.2.3 Startup Procedures	7.4-2
7.4.2.4 Performance Confirmation Procedures	7.4-2
7.4.2.5 Retrieval and Alternate Storage Procedures	7.4-2
7.4.3 GROA Shaft and Ramps Facilities Operations Procedures	7.4-2
7.4.3.1 Normal Operating Procedures	7.4-2
7.4.3.2 Emergency Procedures	7.4-2
7.4.3.3 Startup Procedures	7.4-2
7.4.3.4 Performance Confirmation Procedures	7.4-2
7.4.3.5 Retrieval and Alternate Storage Procedures	7.4-2
7.4.4 GROA SubSurface Facilities Operations Procedures	7.4-2
7.4.4.1 Normal Operating Procedures	7.4-2
7.4.4.2 Emergency Procedures	7.4-2
7.4.4.3 Startup Procedures	7.4-2
7.4.4.4 Performance Confirmation Procedures	7.4-2
7.4.4.5 Retrieval and Alternate Storage Procedures	7.4-2
REFERENCES	7.4-3
7.5 RECORDS AND REPORTS	7.5-1
7.5.1 Records Management System	7.5-1
7.5.1.1 Master File System	7.5-1
7.5.1.2 Records Protection and Security	7.5-1
7.5.2 Records Requirements	7.5-2
7.5.2.1 Construction Records	7.5-2
7.5.2.2 Site Deficiency Records	7.5-3
7.5.2.3 Records of Tests Conducted Using Radioactive Waste	7.5-3
7.5.2.4 Inspection Records	7.5-3
7.5.2.5 Radioactive Waste Receipt, Handling, Storage and Disposition Records	7.5-3
7.5.2.6 Permanent Closure Records	7.5-4
7.5.2.7 Performance Confirmation Records	7.5-4
7.5.3 Other Records	7.5-4
REFERENCES	7.5-5

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
7.6 TRAINING PROGRAMS	7.6-1
7.6.1 Program Approach	7.6-1
7.6.1.1 General Employee Training	7.6-1
7.6.1.2 Technical Training	7.6-2
7.6.1.3 Development and Management Training	7.6-3
7.6.2 Continuing and Refresher Training	7.6-3
7.6.3 Training Program Evaluation	7.6-3
7.6.4 Training and Qualification Program Records	7.6-3
REFERENCES	7.6-4
7.7 SCHEDULES	7.7-1
7.7.1 Introduction and Overview of Repository Schedules	7.7-1
7.7.2 Repository Overall Schedule	7.7-1
7.7.3 Waste Delivery Schedule	7.7-1
7.7.4 Design Schedule	7.7-1
7.7.5 Construction Schedule	7.7-2
7.7.6 Procurement Schedule	7.7-2
7.7.7 Maintenance Schedule	7.7-2
7.7.8 Performance Evaluation and Testing Schedule	7.7-2
7.7.9 Critical Paths and Milestones	7.7-2
REFERENCES	7.7-3
7.8 IDENTIFICATION OF OPERATING CONTROLS AND LIMITS	7.8-1
7.8.0 Introduction	7.8-1
7.8.1 Surface Facilities Operating Control Limits	7.8-1
7.8.2 Shafts and Ramps Facilities Operating Control Limits	7.8-1
7.8.3 Subsurface Facilities Operating Control Limits	7.8-1
REFERENCES	7.8-3
7.9 PRESERVATION OF RECORDS	7.9-1
7.9.1 Records Identified for Archival	7.9-1
7.9.2 Record Preservation Method	7.9-2
7.9.3 Probable Archive Locations	7.9-2
REFERENCES	7.9-3

TABLE OF CONTENTS (continued)

	Page
8.0 PERFORMANCE CONFIRMATION PROGRAM	8.0-1
REFERENCES	8.0-3
ACRONYMS AND ABBREVIATIONS	8.0-4
8.1 PERFORMANCE CONFIRMATION FOR THE NATURAL SYSTEMS OF THE GEOLOGIC SETTING	8.1-1
8.1.1 Geologic System	8.1-1
8.1.2 Hydrologic System	8.1-2
8.1.3 Geochemical System	8.1-2
8.1.4 Climatological and Meteorological Systems	8.1-2
REFERENCES	8.1-3
8.2 PERFORMANCE CONFIRMATION FOR THE STRUCTURES, SYSTEMS, AND COMPONENTS OF THE GEOLOGIC REPOSITORY OPERATIONS AREA	8.2-1
8.2.1 Surface Facilities	8.2-1
8.2.2 Shafts and Ramps	8.2-1
8.2.3 Underground Facility	8.2-2
REFERENCES	8.2-4
8.3 PERFORMANCE CONFIRMATION FOR THE ENGINEERED BARRIER SYSTEM	8.3-1
8.3.1 Waste Package Monitoring	8.3-1
8.3.1.1 Waste Form	8.3-2
8.3.1.2 In Situ Waste Package Monitoring	8.3-2
8.3.1.3 External Waste Package Monitoring Environment	8.3-2
8.3.1.4 Laboratory Waste Package Monitoring	8.3-2
8.3.1.5 Duration of Post-Emplacement Waste Package Monitoring	8.3-3
8.3.1.6 Demonstration of Compliance	8.3-3
8.3.2 Engineered Barrier and Waste Package Performance Objectives	8.3-4
8.3.2.1 Failure Mode and Effects Analysis	8.3-4
8.3.2.2 Environmental Conditions for Confirmatory Tests and Analyses	8.3-4
8.3.2.3 Confirmatory Tests and Analysis	8.3-4
8.3.2.4 EBS Performance Allocation	8.3-4
8.3.2.5 Results of EBS Performance Confirmation	8.3-5
REFERENCES	8.3-6

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
8.4 RADIATION PROTECTION	8.4-1
REFERENCES	8.4-2
8.5 ANALYSIS OF CHANGES FROM PERFORMANCE CONFIRMATION BASELINE	8.5-1
REFERENCES	8.5-2
9.0 LAND OWNERSHIP AND CONTROL	9.0-1
REFERENCES	9.0-3
ACRONYMS AND ABBREVIATIONS	9.0-4
9.1 PLANS FOR RESTRICTING CONTROLLED AREA ACCESS	9.1-1
9.1.1 Identification of Controlled Area	9.1-1
9.1.1.1 Legal Description of Controlled Area	9.1-2
9.1.1.2 Relevant Features Within and Outside the Controlled Area	9.1-2
9.1.1.3 Description of Limits of the Underground Facility and Maximum Horizontal Distance to Boundary of the Controlled Area	9.1-2
9.1.2 Identification of Existing Legal Interests	9.1-2
9.1.2.1 Existing Present Surface Interests of Record in Lands Within the Controlled Area	9.1-3
9.1.2.1.1 Rights Arising Under the General Mining Laws	9.1-3
9.1.2.1.2 Easements for Right-of-Way	9.1-3
9.1.2.1.3 All Other Rights Arising Under Lease, Rights of Entry, Deed, Patent, Mortgage, Appropriation, Prescription, or Otherwise	9.1-3
9.1.2.2 Existing Future Surface Interests of Record in Lands Within the Controlled Area	9.1-3
9.1.2.2.1 Rights Arising Under the General Mining Laws	9.1-3
9.1.2.2.2 Easements for Right-of-Way	9.1-3
9.1.2.2.3 All Other Rights Arising Under Lease, Rights of Entry, Deed, Patent, Mortgage, Appropriation, Prescription, or Otherwise	9.1-3
9.1.2.3 Existing Present Subsurface Interests of Record in Lands Within the Controlled Area	9.1-3
9.1.2.3.1 Rights Arising Under the General Mining Laws	9.1-4

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
9.1.2.3.2 Easements for Right-of-Way	9.1-4
9.1.2.3.3 All Other Rights Arising Under Lease, Rights of Entry, Deed, Patent, Mortgage, Appropriation, Prescription, or Otherwise	9.1-4
9.1.2.4 Existing Future Subsurface Interests of Record in Lands Within the Controlled Area	9.1-4
9.1.2.4.1 Rights Arising Under the General Mining Laws	9.1-4
9.1.2.4.2 Easements for Right-of-Way	9.1-4
9.1.2.4.3 All Other Rights Arising Under Lease, Rights of Entry, Deed, Patent, Mortgage, Appropriation, Prescription, or Otherwise	9.1-4
9.1.2.5 Acquired Lands Within the Controlled Area that are Under the Jurisdiction and Control of DOE	9.1-4
9.1.2.6 Lands Within the Controlled Area that have been Permanently Withdrawn and Reserved for DOE Use	9.1-5
9.1.3 Identification of Legal Interests to be Obtained	9.1-5
9.1.3.1 Legal Authority	9.1-5
9.1.3.1.1 Statutes	9.1-5
9.1.3.1.2 Judicial Decisions	9.1-5
9.1.3.2 Encumbrances That DOE Proposes Not to Acquire	9.1-5
9.1.3.2.1 Identification	9.1-5
9.1.3.2.2 Why They are Not Significant to Achievement of the Purpose of 10 CFR 60	9.1-5
9.1.3.3 Identification of Relevant Legal Records and Their Locations . .	9.1-5
9.1.4 Water Rights Within the Controlled Area	9.1-6
9.1.4.1 Identification of Water Rights Needed to Accomplish the Purpose of the GROA	9.1-6
9.1.4.1.1 Water for Personnel Needs	9.1-6
9.1.4.1.2 Water for Equipment Needs	9.1-6
9.1.4.1.3 Fire Protection Water	9.1-6
9.1.4.2 Quantitative Information by Water Category	9.1-6
9.1.4.3 Qualitative Information by Water Category	9.1-6
REFERENCES	9.1-7
9.2 PLANS FOR REGULATING LAND USE OUTSIDE THE CONTROLLED AREA	9.2-1
9.2.1 Identification of Adjacent Areas of Concern	9.2-1
9.2.1.1 Legal Description of Areas of Concern (Outside the Controlled Area)	9.2-1
9.2.1.2 Human Actions (Outside the Controlled Area) Considered to Have the Potential to Affect the Geologic Repository	9.2-1

Date: 03/31/95

TABLE OF CONTENTS (continued)

9.2.2	Identification of Existing Legal Interests	9.2-1
9.2.2.1	Existing Present Surface Interests of Record in Lands Within the Adjacent Areas of Concern (Outside the Controlled Area)	9.2-1
9.2.2.1.1	Rights Arising Under the General Mining Laws	9.2-1
9.2.2.1.2	Easements for Right-of-Way	9.2-1
9.2.2.1.3	All Other Rights Arising Under Lease, Rights of Entry, Deed, Patent, Mortgage, Appropriation, Prescription, or Otherwise	9.2-2
9.2.2.2	Existing Future Surface Interests of Record in Lands Within the Adjacent Areas of Concern (Outside the Controlled Area)	9.2-2
9.2.2.2.1	Rights Arising Under the General Mining Laws	9.2-2
9.2.2.2.2	Easements for Right-of-Way	9.2-2
9.2.2.2.3	All Other Rights Arising Under Lease, Rights of Entry, Deed, Patent, Mortgage, Appropriation, Prescription, or Otherwise	9.2-2
9.2.2.3	Existing Present Subsurface Interests of Record Within the Adjacent Areas of Concern (Outside the Controlled Area)	9.2-2
9.2.2.3.1	Rights Arising Under the General Mining Laws	9.2-2
9.2.2.3.2	Easements for Right-of-Way	9.2-3
9.2.2.3.3	All Other Rights Arising Under Lease, Rights of Entry, Deed, Patent, Mortgage, Appropriation, Prescription, or Otherwise	9.2-3
9.2.2.4	Existing Future Subsurface Interests of Record in Lands Within the Adjacent Areas of Concern (Outside the Controlled Area)	9.2-3
9.2.2.4.1	Rights Arising Under the General Mining Laws	9.2-3
9.2.2.4.2	Easements for Right-of-Way	9.2-3
9.2.2.4.3	All Other Rights Arising Under Lease, Rights of Entry, Deed, Patent, Mortgage, Appropriation, Prescription, or Otherwise	9.2-3
9.2.2.5	Water Rights Within the Adjacent Areas of Concern (Outside the Controlled Area)	9.2-4
9.2.2.5.1	Identification of Existing Water Rights	9.2-4
9.2.2.5.1.1	Water for Personnel Needs	9.2-4
9.2.2.5.1.2	Water for Equipment Needs	9.2-4
9.2.2.5.1.3	Fire Protection Water	9.2-4
9.2.2.5.2	Quantitative Information by Water Category	9.2-4
9.2.2.5.3	Qualitative Information by Water Category	9.2-4

TABLE OF CONTENTS (continued)

9.2.2.6	Evaluation of the Extent to Which, in the Absence of Unanticipated Processes and Events, DOE's Jurisdiction and Control of the Legal Interests Would Serve to Prevent Adverse Human Actions that Could Significantly Reduce the Geologic Repository's Capability for Isolation	9.2-4
9.2.2.7	Identification of Existing Relevant Legal Records and Their Locations	9.2-5
9.2.3	Identification of Legal Interests to be Obtained Within the Adjacent Areas of Concern (Outside the Controlled Area)	9.2-5
9.2.3.1	Legal Authority	9.2-5
9.2.3.1.1	Statutes	9.2-5
9.2.3.1.2	Judicial Decisions	9.2-5
9.2.3.2	Encumbrances that DOE Proposes Not to Acquire	9.2-5
9.2.3.2.1	Identification	9.2-5
9.2.3.2.2	Why They Are Not Significant to Achievement of the Purposes of 10 CFR 60	9.2-5
9.2.3.3	Identification of Relevant Legal Records to be Obtained and Their Locations	9.2-5
9.2.3.4	Water Rights Within the Adjacent Areas of Concern Needed to Accomplish the Purpose of the GROA or Needed to Preclude Potential Adverse Human Actions that Could Significantly Reduce the Geologic Repository's Capability for Isolation	9.2-6
9.2.3.4.1	Water for Personnel Needs	9.2-6
9.2.3.4.2	Water for Equipment Needs	9.2-6
9.2.3.4.3	Fire Protection Water	9.2-6
9.2.3.4.4	Water Rights to Control Potential Adverse Human Actions Detrimental to the Achievement of the Purposes of 10 CFR 60	9.2-6
9.2.3.4.5	Quantitative Information for Water by Category	9.2-6
9.2.3.4.6	Qualitative Information for Water by Category	9.2-6
REFERENCES	. . . . .	9.2-7
9.3	PLANS FOR REGULATING LAND USE AT THE GROA	9.3-1
9.3.1	"Restricted Area" Land that the DOE has Obtained	9.3-1
9.3.1.1	Access Control Measures	9.3-1
9.3.1.2	Specific Measures to Protect Individuals	9.3-1
9.3.2	"Restricted Area" Land that the DOE Will Obtain	9.3-1
9.3.2.1	Access Control Measures	9.3-1
9.3.2.2	Specific Measures to Protect Individuals	9.3-1

Date: 03/31/95

TABLE OF CONTENTS (continued)

9.3.3 Land to Which the DOE Has Rights of Access and Which Are Available to Nuclear Regulatory Commission Inspections	9.3-2
REFERENCES	9.3-3
10.0 INTRODUCTION	10.0-1
10.0.1 Application of QA Programs to Structures, Systems, and Components (SSCs) Important to Safety and Waste Isolation	10.0-2
10.0.1.1 Identification of SSCs Important to Safety	10.0-2
10.0.1.2 Description of Analyses Used To Determine SSCs Important to Safety	10.0-2
10.0.1.3 Engineered Barriers Important to Waste Isolation That Are Subject to QA Programs	10.0-2
10.0.1.4 Evaluations That Were Used to Identify Engineered Barriers Important to Waste Isolation and Subject to QA Programs ...	10.0-2
10.0.1.5 SSCs and Engineered Barriers Identified Above and Their Descriptions Are Incorporated into the 10 CFR 60, Subpart G, QA Programs for Site Characterization	10.0-2
10.0.2 Activities Related to Items on the Q-List (YMP/90-55Q)	10.0-2
10.0.3 QA Program Description for 10 CFR 60.131(a) Items Other than Those Important to Safety or Waste Isolation	10.0-2
10.0.4 Assessment of Activities During Site Characterization and Their Compliance with QA Program Requirements	10.0-2
REFERENCES	10.0-3
10.1 QA PROGRAMS FOR VARIOUS ACTIVITIES ASSOCIATED WITH THE GEOLOGIC REPOSITORY	10.1-1
10.1.1 QA Program for Site Characterization	10.1-1
10.1.1.1 Applicable Provisions of 10 CFR 50, Appendix B (as specified in the QARD) That Have Been Applied to Activities Affecting Quality During Site Characterization of the Geologic Repository	10.1-1
10.1.1.1.1 QA Program for the Yucca Mountain Site Characterization Office (YMSCO)	10.1-1
10.1.1.1.1.1 Operating Contractor (M&O)	10.1-1
10.1.1.1.1.2 QA Program for Reynolds Electrical & Engineering Company (REECO)	10.1-1
10.1.1.1.1.3 QA Program for United States Geological Survey (USGS)	10.1-1
10.1.1.2 Provisions Sufficiently Detailed to Respond to NRC "Review Plan for High-Level Waste Repository QA Program Descriptions"	10.1-1

Date: 03/31/95

TABLE OF CONTENTS (continued)

10.1.1.3	Existing Data That Has Not Been Gathered Under 10 CFR 60, Subpart G and Requires Qualification for Use in Licensing . . .	10.1-1
10.1.2	QA Program for Design and Construction	10.1-1
10.1.2.1	Provisions of 10 CFR 50, Appendix B (as specified in the QARD) That Are Applicable to Design and Construction Activities and That Have Been Previously Detailed for the Site Characterization QA Program	10.1-1
10.1.2.2	Provisions of 10 CFR 50, Appendix B (as specified in the QARD) That Are Applicable to Design and Construction Activities and That Have Not Previously Been Applied for the Site Characterization QA Program (With Sufficient Detail to Permit Evaluation by NRC of Compliance With 10 CFR 50, Appendix B)	10.1-1
10.1.3	QA Program for Performance Confirmation	10.1-1
10.1.3.1	Particular QA Site Characterization Program	10.1-1
10.1.3.2	Provisions of 10 CFR 50, Appendix B (as specified in the QARD) That Will Be Applied to the Performance Confirmation Program and That Have Not Been Previously Applied for the Site Characterization QA Program (In Sufficient Detail to Permit Evaluation by NRC of 10 CFR 50, Appendix B Compliance)	10.1-2
10.1.4	QA Program for Operations, Permanent Closure, Decontamination, and Decommissioning	10.1-2
10.1.4.1	Provisions That Are the Same as Those Previously Described for the Site Characterization QA Program	10.1-2
10.1.4.2	Provisions of 10 CFR 50, Appendix B (as specified in the QARD) That Will Be Applied to the Operations, Permanent Closure, Decontamination, and Decommissioning Phases of the Geologic Repository	10.1-2
REFERENCES	. . . . .	10.1-3
10.2	IMPLEMENTATION OF THE QA PROGRAM FOR SITE CHARACTERIZATION	10.2-1
REFERENCES	. . . . .	10.2-2
11.1	SITE DESCRIPTION	11.1-1
11.1.1	Description of Licensed Activity	11.1-1
11.1.2	Location	11.1-1
11.1.2.1	Demography	11.1-2
11.1.2.1.1	Permanent Population	11.1-2
11.1.2.1.2	Transient Population	11.1-2

Date: 03/31/95

TABLE OF CONTENTS (continued)

11.1.2.2	Land Use Census	11.1-2
11.1.3	Facility and Site Description	11.1-2
REFERENCES	.....	11.1-3
11.2	TYPES OF ACCIDENTS	11.2-1
11.2.1	Postulated Accidents and Abnormal Operational Events	11.2-1
11.2.1.1	Postulated Accidents	11.2-1
11.2.1.1.1	Natural Phenomena	11.2-1
11.2.1.1.2	Nuclear Criticality	11.2-1
11.2.1.1.3	Failure of Equipment	11.2-1
11.2.1.1.4	Fires in Critical Areas	11.2-1
11.2.1.2	Abnormal Operational Events	11.2-1
11.2.2	Detection of Emergency Conditions	11.2-1
11.2.2.1	Process System	11.2-1
11.2.2.2	Alarm System and Release Prevention	11.2-1
REFERENCES	.....	11.2-2
11.3	CLASSIFICATION OF ACCIDENTS	11.3-1
11.3.1	Classification System	11.3-1
11.3.1.1	Unusual Event	11.3-1
11.3.1.2	Alert	11.3-1
11.3.1.3	Site Area Emergency	11.3-1
11.3.1.4	Initiating Conditions/Emergency Action Levels	11.3-1
11.3.2	Notification and Coordination	11.3-1
11.3.3	Information to be Communicated	11.3-2
11.3.3.1	Emergency Message Form	11.3-2
11.3.3.2	Supporting Information	11.3-2
REFERENCES	.....	11.3-3
11.4	RESPONSIBILITIES	11.4-1
11.4.1	Normal Facility Organization	11.4-1
11.4.2	Facility Organization During Emergency Conditions	11.4-1
11.4.2.1	Emergency Coordinator	11.4-1
11.4.2.2	Shift Manager	11.4-2
11.4.2.3	MGDS Facility Manager	11.4-2
11.4.2.4	Operations Manager	11.4-2
11.4.2.5	Technical Support Manager	11.4-2
11.4.2.6	Maintenance Manager	11.4-3
11.4.2.7	Compliance Manager	11.4-3
11.4.2.8	Evacuation Coordinator	11.4-3

Date: 03/31/95

TABLE OF CONTENTS (continued)

11.4.2.9	Radiation/Chemical Protection Manager	11.4-3
11.4.2.10	Community Relations Coordinator	11.4-4
11.4.3	Local Off-Site Assistance to the MGDS Facility	11.4-4
11.4.4	Coordination with Participating Government Agencies	11.4-4
REFERENCES	.....	11.4-6
11.5	EMERGENCY RESPONSE MEASURES	11.5-1
11.5.1	Activation of Emergency Response Organization	11.5-1
11.5.2	Assessment and Corrective Actions	11.5-1
11.5.2.1	Dose Assessment	11.5-1
11.5.2.2	Hazardous Material Release	11.5-1
11.5.3	Mitigating Actions	11.5-1
11.5.4	Protective Actions	11.5-1
11.5.4.1	Provisions	11.5-1
11.5.4.2	Contamination Control	11.5-2
11.5.5	Exposure Control in Radiological Emergencies	11.5-2
11.5.5.1	Emergency Radiation Exposure Control Program	11.5-2
11.5.5.1.1	Exposure and Monitoring	11.5-2
11.5.5.1.2	Emergency Worker Exposure Guidelines	11.5-2
11.5.5.1.3	Monitoring	11.5-2
11.5.5.2	Decontamination of Personnel	11.5-3
11.5.6	Medical Transportation	11.5-3
11.5.7	Medical Treatment	11.5-3
REFERENCES	.....	11.5-4
11.6	EMERGENCY RESPONSE EQUIPMENT AND FACILITIES	11.6-1
11.6.1	Central Control Room	11.6-1
11.6.2	On Site Communications Equipment	11.6-1
11.6.3	On Site Medical Facilities	11.6-1
11.6.4	Emergency Monitoring Equipment	11.6-1
11.6.4.1	Liquid Effluent Monitors	11.6-1
11.6.4.2	Air Monitors	11.6-2
11.6.4.3	Meteorological Monitors	11.6-2
REFERENCES	.....	11.6-3
11.7	MAINTENANCE OF EMERGENCY PREPAREDNESS CAPABILITY	11.7-1
11.7.1	Written Emergency Plan Implementation Procedures	11.7-1
11.7.2	Training	11.7-1
11.7.2.1	General Aspects	11.7-1
11.7.2.2	Training Period	11.7-1
11.7.2.3	Facility Organization Training	11.7-2

TABLE OF CONTENTS (continued)

11.7.2.4	Training Radiological Protection Monitoring Team Personnel	11.7-2
11.7.2.5	First Aid Training	11.7-2
11.7.2.6	Emergency Response Training (Off-Site Agency)	11.7-2
11.7.2.7	Off-Site Support	11.7-2
11.7.3	Drills and Exercises	11.7-2
11.7.4	Exercise Critiques	11.7-3
11.7.5	Critique Action Items	11.7-3
11.7.6	Review and Updating of the Plan and Procedures	11.7-3
11.7.7	Maintenance and Inventory of Emergency Equipment, Instrumentation, and Supplies	11.7-3
11.7.8	Verification of Emergency Telephone Numbers	11.7-4
REFERENCES		11.7-5
11.8	RECORDS AND REPORTS	11.8-1
11.8.1	Records of Incidents	11.8-1
11.8.2	Records of Preparedness Assurance	11.8-1
REFERENCES		11.8-2
11.9	RECOVERY DESCRIPTION	11.9-1
11.9.1	Downgrade/Termination of an Emergency	11.9-2
11.9.2	Recovery Organization	11.9-3
11.9.3	Resumption of Normal Operations	11.9-3
REFERENCES		11.9-4

MGDS License Application Annotated Outline

Chapter 1.0 General Information

TABLE OF CONTENTS

	Page
1.0 GENERAL INFORMATION	1.0-1
1.0.1 Overview of the Proposed Repository	1.0-3
1.0.2 General Layout and Design	1.0-4
REFERENCES	1.0-8
ACRONYMS AND ABBREVIATIONS	1.0-9

LIST OF TABLES

Date: 03/31/95

LIST OF FIGURES

- 1.0-1 General Location of Yucca Mountain Site in Southern Nevada
 [INN 1.0-2]
- 1.0-2 Topographical Map of Surface and Underground Facilities [INN 1.0-3]
- 1.0-3 General Location Map of Site Surface and Underground Facilities
 [INN 1.0-4]
- 1.0.2-1 General Location of Central Facilities [INN 1.0.2-3, INN 1.0.2-4, INN
 1.0.2-7]
- 1.0.2-2 General Drawing of Underground Facility Ventilation System [INN 1.0.2-3,
 INN 1.0.2-4]
- 1.0.2-3 General Drawing of Waste Panel Development [INN 1.0.2-8]
- 1.0.2-4 General Drawing of Waste Emplacement Drifts [INN 1.0.2-9]
- 1.0.2-5 General Drawing of Waste Package and Components [INN 1.0.2-13]
- 1.0.2-6 General Drawing of Disposal Containers for Both Waste Types
 [INN 1.0.2-16]
- 1.0.2-7 General Drawing of Topopah Tuff and Waste Emplacement Area
 [INN 1.0.2-17]

Date: 03/31/95

LIST OF INFORMATION NEEDS

- 1.0-1 DOE names for Safety Analysis Report, Environmental Report, Security Plan, and Emergency Plan
- 1.0-2 Drawing of the U.S. identifying the NTS, Nellis Air Force Base, and BLM lands in southern Nevada; included should be an enlargement of the area identifying Yucca Mountain with the boundary of the repository identified
- 1.0-3 Drawing to be used as Figure 1.0-2 in LA to provide a topographical view of Yucca Mountain depicting the aboveground and underground facilities; this drawing should also include a contour interval legend
- 1.0-4 Drawing to be used as Figure 1.0-3 in LA to provide a general description of the repository site, above ground and underground facilities and their interconnection; e.g., ramps, railroad, tuff pile, major buildings
- 1.0-5 DOE Contact for NRC LA; DOE also needs to identify others to receive NRC LA correspondence
- 1.0.2-1 Need location of MRS; date MRS is licensed
- 1.0.2-2 Need location of surface facilities; i.e., east face, west slope of Yucca Mountain
- 1.0.2-3 Drawing of surface facilities
- 1.0.2-4 Need general drawing of underground facility ventilation system; need number of shafts in underground facility; need number of ramps in underground facility; need number of main airways in underground facility
- 1.0.2-5 Number of functional areas in the central surface facility; need to identify the activities to be performed in the surface facilities, e.g., waste receipt, inspection, segregation
- 1.0.2-6 Number of ramps and shafts in repository; location of shafts; identification of shafts used for exploratory studies
- 1.0.2-7 Identification of repository emplacement area and location in Yucca Mountain; need drawing identifying boundary of emplacement areas; number of acres available for emplacement of waste; number of acres called for in conceptual design

LIST OF INFORMATION NEEDS (continued)

- 1.0.2-8 Need description or number of main entry drifts that will extend into underground facility
- 1.0.2-9 Need width of emplacement panels; need length of emplacement panels; date(s) when emplacement panel excavation will occur; direction (SW, NW, NE, etc.) panels will progress; general drawing of waste emplacement panels
- 1.0.2-10 Need date when waste emplacement will begin; need general drawing of waste emplacement drifts
- 1.0.2-11 Need determination as to what type of excavating technique will be used for waste and tuff ramps, long drives, waste main, and perimeter drift; need to know technique that will be used for emplacement drifts
- 1.0.2-12 Need number of years planned for waste emplacement; need number of years caretaker period will last and beginning date
- 1.0.2-13 Need general drawing of waste package and components; need information on topical report for waste package, name, date, submittal/approval dates
- 1.0.2-14 Need to know whether fuel will be consolidated or not; need limit on minimum age of PWR spent fuel or disposal; need information on topical report for waste package, name, date, submittal/approval dates; need spent fuel gamma dose on outer surface of container; need spent fuel neutron dose on outer surface of container; kilowatt thermal decay rate for spent fuel packages, high to low
- 1.0.2-15 Need thermal decay rates for high level waste packages; need gamma dose rate on surface of container for waste package; need neutron dose rate on surface of container for high level waste package
- 1.0.2-16 Need description of disposal container, dimensions, materials; need general drawing of waste forms in disposal containers; need to know which gas(es) will be used to pressurize container as oxidizing inhibitor; need to know what type of mechanisms will be used inside container for each type of waste for shielding, stability, etc.

LIST OF INFORMATION NEEDS (continued)

- 1.0.2-17 Need names of unsaturated rock that will be used for waste environment, e.g., Calico Hills, Topopah; need general drawing of rock formations depicting where the waste emplacement environment will be located with respect to the various formations in [INN 1.0.2-17]; need to know pressure that will be exerted upon waste container; need to know the amount of water to which waste environment will be exposed

Date: 03/31/95

1.0 GENERAL INFORMATION

[Note: The following material is written in the present tense to represent the language that may be used in a potential license application (LA) for the Yucca Mountain Site.]

[Pursuant to 10 CFR 60, *Disposal of High-Level Radioactive Wastes in Geologic Repositories*, Section 21, the U.S. Department of Energy (DOE) hereby makes application for the necessary license to construct, own, use, and operate a mined geologic repository for the disposal of high-level radioactive waste. This application for the proposed repository contains information as required by 10 CFR 60, and has been prepared in accordance with the guidance provided by Regulatory Guide XX [Number will be inserted when Regulatory Guide XX is issued.], "Format and Content for the Application for the High-Level Waste Repository," dated XXXX XX, XXXX [Date will be inserted when the Regulatory Guide is issued]. The LA consists of the following parts:]

- a. [The LA which is set out herein]
- b. [The technical information and safety analysis report required by 10 CFR 60, entitled "DOE Yucca Mountain High-Level Waste Repository Safety Analysis Report", [INN 1.0-1] is forwarded herewith as Chapters 2 through 11, and made a part hereof]
- c. [The physical security information required by 10 CFR 60 and 10 CFR 73, *Physical Protection of Plants and Materials*, which is set forth in a separate document entitled "DOE Yucca Mountain High-Level Waste Repository Physical Security and Safeguards Plan," [INN 1.0-1] forwarded herewith and made part hereof to be withheld from public disclosure pursuant to 10 CFR 2, *Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders*; Section 790(d)(1)]
- d. [The emergency planning information required by 10 CFR 60, which is set forth in a separate document entitled "DOE Yucca Mountain High-Level Waste Repository Emergency Preparedness Plan," [INN 1.0-1] forwarded herewith and made a part hereof.]

[The Final Environmental Impact Statement required by the *Nuclear Waste Policy Act, As Amended*, DOE/RW-0438, which is set forth in a separate document entitled "DOE Yucca Mountain High-Level Waste Repository Environmental Impact Study," [INN 1.0-1] is also forwarded herewith to accompany the LA.]

Date: 03/31/95

Proposed Change:

On December 22, 1987, the United States Congress enacted the NWPAA, which directed the DOE to characterize a site at Yucca Mountain, Nevada as a candidate for the first mined geologic repository for the disposal of high-level radioactive waste.

Yucca Mountain is located in Nye County, approximately 100 miles northwest of Las Vegas (Figure 1.0-1) [INN 1.0-2]. As shown on Figure 1.0-1, Yucca Mountain is located on land managed by the Bureau of Land Management (BLM) of the Department of the Interior, NAFB of the Department of Defense, and the Nevada Test Site (NTS) which has been withdrawn from the public domain and reserved for use by the DOE. Figure 1.0-2 [INN 1.0-3] provides a topographical view of the repository region.

The proposed Yucca Mountain repository, hereafter referred to as the repository, will consist of surface facilities that include systems designed, constructed, and tested to receive and prepare the waste for disposal. Underground facilities connected to the surface by ramps and shafts have been designed and will be constructed and tested prior to the emplacement of the waste. Upon permanent closure, seals will be constructed for the ramps, shafts, and exploratory boreholes (Figure 1.0-3) [INN 1.0-4]. [In order to comply with all applicable regulatory requirements, it must be substantiated by supporting information that the proposed facility may be constructed and operated without unreasonable risk to the health and safety of the public.] [A detailed description and safety analysis for the repository is contained in the Safety Analysis Report contained herein.]

It is requested that all communications pertaining to the LA be transmitted to [INN 1.0-5], and that a copy of each communication be sent to [INN 1.0-5]. [Recommend the DOE general counsel, lead project manager for Office of Civilian Radioactive Waste Management, and the Civilian Radioactive Waste Management System Management and Operating Contractor Licensing Manager].

I, [Name of Secretarial Officer], state that on behalf of the DOE I am authorized to sign and file with NRC this application and exhibits attached hereto; and that all of the statements contained in such application and exhibits attached hereto are true and correct to the best of my knowledge, information, and belief.

Signature_____

Name

[Insert Office Position]

[Office of Civilian Radioactive Waste Management]

[Department of Energy]

Date: 03/31/95

Subscribed and sworn to before me this _____ day of _____.

Signature _____

Notary Public

My commission expires: _____

1.0.1 Overview of the Proposed Repository

Yucca Mountain preliminary site characterization began in 1977, when the U.S. Government investigated the possibility of siting a repository at the NTS. The NTS was proposed for the following reasons:

- a. [In the southern Nevada area, ground water does not discharge into rivers that flow into major bodies of surface water]
- b. [The NTS has geochemical characteristics that are favorable for waste isolation, i.e., retardation of radionuclide migration]
- c. [The paths of ground water flow between the repository and the points of ground water discharge are long]
- d. The region is arid, causing the rate at which ground water is recharged to be very low [with the potential movement of ground water, in unsaturated rock, also very low]
- e. Low population density in surrounding areas
- f. Government ownership of the land

To facilitate weapons testing at the NTS, site characterization was limited to the southwestern portion of the NTS and the adjacent land; therefore, three locations were identified for preliminary testing. One of these locations was Yucca Mountain, which contained a formation of tuff that appeared to be large enough for a repository. Tuff had not previously been considered as a potential host rock for a repository; therefore, the National Academy of Sciences was consulted for its views on investigating the tuff as a host rock. The National Academy of Sciences responded favorably (Gloyne, 1979).

The U.S. Geological Survey also recommended Yucca Mountain as a potential site (Twenhofel, 1979), based on the results of preliminary explorations at the three locations. In 1980, a formal analysis of 15 potential locations indicated Yucca Mountain was preferred, with several potentially suitable horizons within the mountain. Following the preparation of an environmental assessment, the Secretary of the DOE nominated Yucca Mountain as one of

Date: 03/31/95

five sites suitable for characterization, and recommended it be characterized as one of three candidate sites for a repository. This recommendation was approved by the President. Subsequently, on December 22, 1987, the Congress enacted the NWPPA, which directed the DOE to characterize only the Yucca Mountain site.

The Yucca Mountain site is located in Nye County, Nevada, approximately 100 miles (by road) northwest of Las Vegas (see Figure 1.0-1). [As shown in Figure 1.0-1,] the repository is located on federal land including public land managed by the BLM; Nellis Air Force Range (withdrawn from the public domain for use by the Department of Defense), and managed by the BLM; and the NTS (withdrawn from the public domain and reserved for use by the DOE). The site lies in the southwest part of the Great Basin, an arid region with linear mountain ranges and intervening valleys. This region receives little precipitation and has little vegetation and is sparsely populated. Yucca Mountain is approximately 1500 meters above sea level, 370 meters above the western edge of Jackass Flats to the east, and more than 300 meters above the eastern edge of Crater Flats to the west.

Yucca Mountain is part of a group of northern ridges that extend southward from Beatty, Wash northwest to U.S. Highway 95 in the Amargosa Desert (Figure 1.0-1). Steep slopes of 15° to 30° are found on the western side of Yucca Mountain and along some of the valleys that cut into the more gently sloping (5° to 10°) east side of Yucca Mountain. North of Yucca Mountain is the high terrain of Timber Mountain. Along the west side of Crater Flats, fans of stream deposited sediments extend from valleys that have been cut into Bare Mountain. A few basalt cones and small lava flows are present on the surface of the southern half of Crater Flats. The water table at Yucca Mountain is approximately 760 meters below the land surface. Due to limited rainfall and a high evaporation rate, there is little potential for percolation of water downward through the unsaturated zone above the water table.

1.0.2 General Layout and Design

The proposed repository consists of surface and underground facilities connected by ramps and shafts. [Seals have been designed and tested,] and will be constructed for the ramps, shafts, and exploratory boreholes when the repository is permanently closed. The design of the repository is based upon the waste management program that includes the DOE Monitored Retrievable Storage Facility located in [INN 1.0.2-1], and licensed by the NRC on [INN 1.0.2-1].

[The surface facilities of the repository will be designed to receive the waste and prepare it for permanent disposal in the underground facility.] These facilities are located on the [INN 1.0.2-2] of Yucca Mountain and consist of central facilities, outlying support facilities, and facilities that provide access and ventilation for the underground repository (Figures 1.0.2-1 and 1.0.2-2) [INN 1.0.2-3] and [INN 1.0.2-4]. The central surface facilities area is divided into [INN 1.0.2-5] functional areas used for [INN 1.0.2-5] [waste receipt and inspection, waste handling operations, and general support facilities]? The surface facilities are connected to the underground repository through [INN 1.0.2-6] ramps and [INN 1.0.2-6]

Date: 03/31/95

shafts [a number of ramps and shafts will be added]. A rail spur and a road will be constructed for waste that will be shipped by rail or truck.

[The waste ramp will be designed for transporting the waste containers to the underground emplacement area and to provide a fresh air intake for the waste emplacement area. A tuff ramp will be designed for use in the excavation and construction of the underground repository to facilitate removal of mined rock from the repository to the surface where the rock will be stockpiled. Additionally, this ramp will be designed to house the main electrical feeder for the underground facilities and to provide the primary intake airway for the underground development area.] All [INN 1.0.2-6] shafts and ramps are located [INN 1.0.2-6] [east/west?] of the central surface facilities area. [These will be described in Chapter 4.]

The underground repository, where the waste will ultimately be emplaced, will be constructed at a depth of approximately [240 to 340 meters] [may change with design revisions]. The primary horizon for the repository is in the welded tuff formation of the [INN 1.0.2-7] [currently believed to be a Topopah Spring Member]. The boundaries of this area are shown in Figure 1.0.2-1 [INN 1.0.2-7]. An area of [INN 1.0.2-7] acres is available underground for waste emplacement. The [current] repository [conceptual] design calls for using [INN 1.0.2-7] acres. The layout consists of [INN 1.0.2-8] parallel main entry drifts that would extend southwest through the underground facility to provide access to the waste emplacement areas, called emplacement panels. [One of the main drifts will be designed and dedicated to transport waste, another for moving rock and large materials, and another to serve as a main drift ventilation and electrical distribution systems.] The primary component of the underground layout is the emplacement panel which is the area excavated for waste package emplacement (or storage). An emplacement panel is approximately [INN 1.0.2-9] feet wide and [INN 1.0.2-9] feet long and will contain emplacement drifts [INN 1.0.2-9] for waste emplacement. The development of the waste panels will begin in the [INN 1.0.2-9] and progress in a [INN 1.0.2-9] direction as shown in [INN 1.0.2-9] Figure 1.0.2-3. Waste emplacement operations will be conducted in a programmatic sequence following the order of waste panel development.

Waste emplacement will begin after [INN 1.0.2-10] sets of panels have been developed. This method will provide a safe distance between development mining and waste emplacement operations to protect the development personnel from exposure to radiation. [The waste packages will be designed to be placed in the emplacement drifts as shown in Figure 1.0.2-4 [INN 1.0.2-10]. A description of the emplacement techniques is contained in Chapters 4 and 5.]

[Two independent ventilation systems will be designed to serve the underground repository.] One will satisfy ventilation needs for the development and construction of the repository and the other will satisfy ventilation needs for waste emplacement operations. The basic layout of the ventilation system (Figure 1.0.2-2 [INN 1.0.2-4]) consists of [INN 1.0.2-4] shafts, [INN 1.0.2-4] ramps, and [INN 1.0.2-4] main airways emplacement areas on each side of the

Date: 03/31/95

main airways and a perimeter airway that will encircle the repository. [A detailed description of the ventilation system is contained in Chapter 4.]

[Tunnel boring machines [INN 1.0.2-11] were used to excavate the waste and tuff ramps as part of the Exploratory Studies Facility (ESF). Tunnel boring machines are also used for long drifts, the waste main, and the perimeter drift. Waste emplacement drifts are excavated using a [INN 1.0.2-11]. [A detailed description of these plans and methods will be contained in Chapter 5.]

Waste will be retrievable during the emplacement period and for up to 100 years after the start of waste emplacement. Following the waste emplacement period, which is scheduled for [INN 1.0.2-12] years, the caretaker period of [INN 1.0.2-12] years will begin. During both of these periods, tests will be conducted to confirm the repository is performing as designed. At the end of the caretaker period, the repository will be prepared for permanent closure. [Plans for backfilling and sealing so that shafts, ramps, and boreholes do not become potential pathways for flow will be contained in Chapter 4 or 5.] Surface facilities will be decontaminated and dismantled, as required. The site will then be returned to its natural state as provided in the reclamation plan. [A plan for permanent closure of the repository and decontamination and dismantlement of surface facilities, will be provided.]

The waste package design comprises the waste form and the container. The waste package, like the site and the repository, is an element of the repository system, and is the principal engineered barrier. [The waste package is be designed to meet the requirements of 10 CFR 60.] Figure 1.0.2-5 [INN 1.0.2-13] is a general drawing of the components that constitute the waste package. [Chapter 5 provides a detailed description of the waste package as accepted by the NRC in Topical Report [INN 1.0.2-13]] [Reference Safety Evaluation Report dated ____ provided by the NRC. [INN 1.0.2-13]] The waste form will be either spent fuel from commercial reactors, both pressurized water and boiling water types, or high-level waste from defense or commercial sources. The spent fuel from pressurized water reactors will be greater than [INN 1.0.2-14] years old and spent fuel from boiling water reactors will be greater than [INN 1.0.2-14] years old. [A description of typical spent fuel, its burn-up time at discharge, its nominal burn-up time, and the thermal output calculation methods are contained in Chapter 5.]

[The waste container with spent fuel is designed so the maximum gamma dose rate at the outer surface of the container is approximately [INN 1.0.2-14] Rads per hour.] The maximum neutron dose rate on the outer surface of the container will be approximately [INN 1.0.2-14] neutrons per square centimeter. [Spent fuel packages will be designed for thermal decay rates as low as [INN 1.0.2-14] kilowatts and as high as [INN 1.0.2-14] kilowatts.] The high level waste from both commercial and defense sources will be in the form of borosilicate glass solidified in stainless steel canisters. The high level waste containers have been designed for thermal decay rates that will range between [INN 1.0.2-15] kilowatts depending on the source and age of the wastes in the glass matrix. [A description of the thermal output calculation methods are contained in Chapter 5.]

Date: 03/31/95

The gamma dose rate on the surface of the container is approximately [INN 1.0.2-15] Rads per hour, and the neutron dose rate at the surface of the container is approximately [INN 1.0.2-15]. The disposal container for both waste forms is a [INN 1.0.2-16]. Figure 1.0.2-6 [INN 1.0.2-16] provides a general drawing of the waste forms in the appropriate disposal containers. After the waste is loaded into the disposal container, it will be filled with an inert gas [INN 1.0.2-16] to provide a non-oxidizing environment, and the top will then be welded shut. The top of the container has a fixture for lifting and lowering the container. A loaded container will weigh between [INN 1.0.2-16] and [INN 1.0.2-16] tons depending on the quantity and type of waste. The containers for spent fuel will contain components/ compartments to maintain the spent fuel in a stable position for container loading. These mechanisms have been designed to accommodate [INN 1.0.2-16] [the different types of spent fuel, and to accommodate consolidated and non-consolidated fuel].

[The partially saturated portion of the [INN 1.0.2-17] tuff, as shown in Figure 1.0.2-7, [INN 1.0.2-17] will provide a waste emplacement environment acceptable for the permanent storage and long-term performance of the waste package.] The external pressure exerted on the disposal containers has been calculated to be approximately [INN 1.0.2-17] pounds per square inch. There will be no hydrostatic pressure because the repository is above the water table, [and the waste packages will not be subject to loads induced by potential creeping of the rock.] The potential water available for corrosion of containers and the dissolution of the waste package or form is limited to small amounts [INN 1.0.2-17]. [A detailed description of the physical conditions in the waste emplacement environment is contained in Chapter 5.]

REFERENCES

DOE/RW-0199, Yucca Mountain Site Characterization Plan

DOE/RW-0438, Nuclear Waste Policy Act, as Amended

42 USC 10101, Nuclear Waste Policy Amendments Act of 1987

YMP/90-33, Yucca Mountain Site Characterization Plan Overview

10 CFR 2, Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders

10 CFR 60, Disposal of High-Level Radioactive Wastes in Geologic Repositories

10 CFR 73, Physical Protection of Plants and Materials

Gloyna, E. F., 1979. Letter from E. F. Gloyna, Chairman, National Research Council, to S. Meyers, DOE Office of Nuclear Waste Management, April 23, 1979 summarizing basis for interest in developing a high-level nuclear waste repository in tuff.

Twenhofel, W. S., 1979. Letter from W. S. Twenhofel, USGS, to R. M. Nelson, DOE/NVO, April 24, 1979 presenting technical findings by the USGS for several geological units in the Yucca Mountain vicinity.

ACRONYMS AND ABBREVIATIONS

BLM	Bureau of Land Management
DOE	U.S. Department of Energy
EBS	Engineered Barrier System
ESF	Exploratory Studies Facility
GROA	Geologic Repository Operations Area
LA	License Application
MGDS	Mined Geologic Disposal System
MSSA	Master Safeguards and Security Agreement
NAFB	Nellis Air Force Base
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
NWPAA	Nuclear Waste Policy Amendments Act
PSP	Physical Security Plan
SCP	Site Characterization Plan

FIGURE CAPTIONS

Figure 1.0-1 General Location of Yucca Mountain Site in Southern Nevada

Map showing location relative to Las Vegas, State Boundary, Nellis AFB, NTS, BLM land, etc. [INN 1.0-2] Probably the existing map Figure 2-3 from the SCP will satisfy this.

Figure 1.0-2 Topographical Map of Surface and Underground Facilities [see INN 1.0-3]

Map showing repository site, both above ground and underground facilities and interconnection, i.e., ramps, railroad, tuff pile, etc.

Figure 1.0-3 General Location Map of Site Surface and Underground Facilities [INN 1.0-4]

Figure 1.0.2-1 General Location of Central Facilities [see INNs 1.0.2-3, 1.0.2-4, and 1.0.2-6]

Figure 1.0.2-2 General Drawing of Underground Facility Ventilation System [INN 1.0.2-3 and 1.0.2-4]

Figure 1.0.2-3 General Drawing of Waste Panel Development [see INN 1.0.2-9]

Figure 1.0.2-4 General Drawing of Waste Emplacement Drifts

General drawing showing location, dimensions, orientation of emplacement drifts. [INN 1.0.2-10]

Figure 1.0.2-5 General Drawing of Waste Package and Components

Need drawing of package showing components with dimensions, materials, and how package and waste fit together. [INN 1.0.2-13]

Figure 1.0.2-6 General Drawing of Disposal Containers for Both Waste Types

Drawing to show high-level waste and spent fuel disposal containers, dimensions, orientation, material, etc. [INN 1.0.2-16]

Figure 1.0.2-7 General Drawing of Topopah Tuff and Waste Emplacement Area

Need drawing of rock formation depicting where waste emplacement will be located with respect to Topopah and Calico Hills. [INN 1.0.2-17]

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.0-1
Section Number and Title:	1.0 GENERAL INFORMATION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	A. DOE name for Safety Analysis Report B. DOE name for Environmental Report C. DOE name for Security Plan D. DOE name for Emergency Plan
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	DOE Headquarters
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.0-2
Section Number and Title:	1.0 GENERAL INFORMATION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 1.0-1
Explicit description of the needed information:	A drawing of the U.S. identifying the NTS, NAFB, and BLM lands in southern Nevada. Included should be an enlargement of the area identifying Yucca Mountain with the boundary of the repository identified.
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Conceptual Design Report
Information Source Description:	<i>Site Characterization Plan, (SCP) DOE/RW-0199, Overview Figure 2-3 is an example of the drawing needed.</i>
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.0-3
Section Number and Title:	1.0 GENERAL INFORMATION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 1.0-2
Explicit description of the needed information:	Drawing to be used as Figure 1.0-2 in LA to provide a topographical view of Yucca Mountain depicting the aboveground and underground facilities. This drawing should also include a contour interval legend.
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Design group
Information Source Description:	Reference SCP overview Figure 3.2 is an example of the drawing needed.
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.0-4
Section Number and Title:	1.0 GENERAL INFORMATION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 1.0-3
Explicit description of the needed information:	Drawing to be used as Figure 1.0-3 in LA to provide a general description of the repository site, both above ground and underground facilities and their interconnection, e.g., ramps, railroad, tuff pile, major buildings.
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Design group
Information Source Description:	SCP overview Figure 3.1 is an example of the drawing needed
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.0-5
Section Number and Title:	1.0 GENERAL INFORMATION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	A. DOE contact for NRC LA B. DOE also needs to identify others to receive NRC LA correspondence
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	DOE Headquarters
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.0.2-1
Section Number and Title:	1.0 GENERAL INFORMATION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	A. Need location of Monitored Retrievable Storage B. Date Monitored Retrievable Storage is licensed
Information will be used to support:	
The Information is needed by/for (date or event):	Prior to LA submittal date
Most likely source of the Information:	Monitored Retrievable Storage Siting Group and DOE Headquarters
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.0.2-2
Section Number and Title:	1.0 GENERAL INFORMATION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	Need location of surface facilities, i.e., east face, west slope of Yucca Mountain
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Design group
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.0.2-3
Section Number and Title:	1.0 GENERAL INFORMATION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 1.0.2-1 and Figure 1.0.2-2
Explicit description of the needed information:	Drawing of surface facilities
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Design group
Information Source Description:	Figure 3-5 of SCP overview is example of drawing needed
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.0.2-4
Section Number and Title:	1.0 GENERAL INFORMATION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 1.0.2-1 and Figure 1.0.2-2
Explicit description of the needed information:	A. Need general drawing of underground facility ventilation system B. Need number of shafts in underground facility C. Need number of ramps in underground facility D. Need number of main airways in underground facility
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Design group
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.0.2-5
Section Number and Title:	1.0 GENERAL INFORMATION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	A. Number of functional areas in the central surface facility B. Need to identify the activities to be performed in the surface facilities, e.g., waste receipt, inspection, segregation
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Design group
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.0.2-6
Section Number and Title:	1.0 GENERAL INFORMATION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	A. Number of ramps in the repository B. Number of shafts in the repository C. Need location of shafts D. Need identification of shaft(s) used for exploratory studies
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Design group
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.0.2-7
Section Number and Title:	1.0 GENERAL INFORMATION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 1.0.2-1
Explicit description of the needed information:	A. Identification of repository emplacement area and location in Yucca Mountain B. Need drawing identifying boundary of emplacement areas C. Number of acres available for emplacement of waste D. Number of acres called for in conceptual design
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Design group
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.0.2-8
Section Number and Title:	1.0 GENERAL INFORMATION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	Need description or number of main entry drifts that will extend into underground facility
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Design group
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.0.2-9
Section Number and Title:	1.0 GENERAL INFORMATION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 1.0.2-3
Explicit description of the needed information:	A. Need width of emplacement panels B. Need length of emplacement panels C. Date(s) when emplacement panel excavation will occur D. Direction (SW, NW, NE, etc.) panels will progress E. General drawing of waste emplacement panels
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Design group
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.0.2-10
Section Number and Title:	1.0 GENERAL INFORMATION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 1.0.2-4
Explicit description of the needed information:	A. Need date when waste emplacement will begin B. Need decisions on waste emplacement C. Need general drawing of waste emplacement drifts
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Design group
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.0.2-11
Section Number and Title:	1.0 GENERAL INFORMATION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	<p>A. Need determination as to what type of excavating technique will be used for waste and tuff ramps, long drives, waste main, and perimeter drift</p> <p>B. Need to know technique that will be used for emplacement drifts</p>
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Mining Contractor (REECo)
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.0.2-12
Section Number and Title:	1.0 GENERAL INFORMATION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	A. Need number of years planned for waste emplacement B. Need number of years caretaker period will last and beginning date
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Design group
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.0.2-13
Section Number and Title:	1.0 GENERAL INFORMATION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 1.0.2-5
Explicit description of the needed information:	A. Need general drawing of waste package and components B. Need information on topical report for waste package, name, date, submittal/approval dates
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Design group
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.0.2-14
Section Number and Title:	1.0 GENERAL INFORMATION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	A. Need to know whether fuel will be consolidated or not B. Need limit on minimum age of PWR spent fuel or disposal C. Needed information on topical report for waste package, name, date, submittal/approval dates D. Need spent fuel gamma dose on outer surface of container E. Need spent fuel neutron dose on outer surface of container F. Kilowatt thermal decay rate for spent fuel packages, high and low
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Sandia National Lab
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.0.2-15
Section Number and Title:	1.0 GENERAL INFORMATION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	A. Need thermal kilowatt thermal decay rates for high level waste packages B. Need gamma dose rate on surface of container for waste package C. Need neutron dose rate on surface of container for high level waste package
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Design group
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.0.2-16
Section Number and Title:	1.0 GENERAL INFORMATION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 1.0.2-6
Explicit description of the needed information:	A. Need description of disposal container, dimensions, materials B. Need general drawing of waste forms in disposal containers C. Need to know which gas(es) will be used to pressurize container as oxidizing inhibitor D. Need to know what type of mechanisms will be used inside container for each type of waste for shielding, stability, etc.
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Design group
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.0.2-17
Section Number and Title:	1.0 GENERAL INFORMATION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 1.0.2-7
Explicit description of the needed information:	<p>A. Need names of unsaturated rock that will be used for waste environment, e.g., Calico Hills, Topopah</p> <p>B. Need general drawing of rock formations depicting where the waste emplacement environment will be located with respect to the various formations in [INN 1.0.2-17]</p> <p>C. Need to know pressure that will be exerted upon waste container</p> <p>D. Need to know the amount of water of which waste environment will be exposed</p>
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Design group
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS License Application Annotated Outline

Section 1.1 General Facility Description

Date: 03/31/95

TABLE OF CONTENTS

	Page
1.1 GENERAL FACILITY DESCRIPTION	1.1-1
1.1.1 Site Description	1.1-1
1.1.1.1 General Description	1.1-1
1.1.1.2 Geologic Setting	1.1-1
1.1.1.3 Geologic Repository Operations Area (GROA)	1.1-1
1.1.1.4 Boundaries	1.1-1
1.1.1.4.1 Natural Boundaries	1.1-1
1.1.1.4.2 Manmade Boundaries	1.1-1
1.1.1.5 Site Features	1.1-2
1.1.1.6 Engineered Barriers	1.1-2
1.1.1.7 Roads	1.1-2
1.1.1.8 Transportation Link	1.1-2
1.1.1.9 Natural System	1.1-2
1.1.1.9.1 Geology	1.1-2
1.1.1.9.2 Hydrology	1.1-2
1.1.1.9.3 Geochemistry	1.1-2
1.1.1.9.4 Meteorology and Climate	1.1-2
1.1.2 Design of Major Structures	1.1-2
1.1.2.1 Above Ground Structures	1.1-3
1.1.2.1.1 Permanent	1.1-3
1.1.2.1.2 Temporary	1.1-3
1.1.2.2 Below Ground Structures	1.1-3
1.1.2.2.1 Permanent	1.1-3
1.1.2.2.2 Temporary	1.1-3
1.1.3 Summary of Activities ("Plans")	1.1-3
1.1.3.1 Operation	1.1-3
1.1.3.2 Decommissioning	1.1-3
1.1.3.3 Permanent Closure	1.1-3
REFERENCES	1.1-4

LIST OF TABLES

- 1.1.1.9.3-1 Geochemical Features [INN 1.1.1.9.3-1]
- 1.1.1.9.4-1 Meteorological Features [INN 1.1.1.9.4-1]
- 1.1.2-1 Site Structures [INN 1.1.2-1]

LIST OF FIGURES

- 1.1.1.1-1 High-Level Waste Repository Site [INN 1.1.1.1-1]
- 1.1.1.2-1 Geologic Setting [INN 1.1.1.2-1]
- 1.1.1.3-1 Site Plot Plan [INN 1.1.1.3-1]
- 1.1.1.4.1-1 Natural Site Boundaries [INN 1.1.1.4.1-1]
- 1.1.1.4.2-1 Manmade Boundaries [INN 1.1.1.4.2-1]
- 1.1.1.4.2-2 Engineered Barriers [INN 1.1.1.4.2-1]
- 1.1.1.7-1 High-Level Waste Repository Site [INN 1.1.1.7-1]
- 1.1.1.9.2-1 Hydrologic Features [INN 1.1.1.9.2-1]
- 1.1.1.9.4-1 Wind Rose [INN 1.1.1.9.4-2]
- 1.1.2-1 Structures [INN 1.1.2-1]

LIST OF INFORMATION NEEDS

- 1.1.1.1-1 Map location of site, including roads and other transportation links.
- 1.1.1.2-1 Map or drawings of geologic setting.
- 1.1.1.3-1 Plot plan of GROA with structures identified.
- 1.1.1.4.1-1 Map or drawings with natural site boundaries.
- 1.1.1.4.2-1 Map or drawings with manmade boundaries.
- 1.1.1.7-1 Map location of site, including roads and other transportation links.
- 1.1.1.9.2-1 Diagram of hydrologic features at the site.
- 1.1.1.9.3-1 Table of geochemical features at the site.
- 1.1.1.9.4-1 Diagram of meteorological features at the site.
- 1.1.1.9.4-2 Figure of wind rose at the site.
- 1.1.2-1 List of structures on site.

Date: 03/31/95

1.1 GENERAL FACILITY DESCRIPTION

This section presents a general description of the high-level nuclear waste repository including its location, general layout and design.

[Note: This section essentially is an executive summary of the project. Items discussed in this section will be detailed in other sections. As these sections are developed, the text in this section will be more fully developed.]

1.1.1 Site Description

[Note: This section will be developed when the proposed facility design is completed.]

1.1.1.1 General Description

[Note: This section will present a general description of the site location (see Section 4.0). Utilize the map in Figure 1.1.1.1-1 [INN 1.1.1.1-1] including the site location.]

1.1.1.2 Geologic Setting

[Note: This section will present a synopsis of the of the geologic setting, and will be developed after Section 3.1 is prepared. Also see Section 3.0 and Figure 1.1.1.2-1 [INN 1.1.1.2-1].]

1.1.1.3 Geologic Repository Operations Area (GROA)

[Note: This section will present a summary of the GROA, and will be written after Section 4.0 has been developed to provide sufficient detail on the proposed design. Also see Section 4.1 and utilize the plot plan in Figure 1.1.1.3-1 [INN 1.1.1.3-1].]

1.1.1.4 Boundaries**1.1.1.4.1 Natural Boundaries**

[Note: See Section 3.0 and utilize the map (and/or drawings) in Figure 1.1.1.4.1-1 [INN 1.1.1.4.1-1].]

1.1.1.4.2 Manmade Boundaries

[Note: See Section 4.1 and discuss purposes of boundaries. Utilize map and drawings in Figures 1.1.1.4.2-1 and 1.1.1.4.2-2][INN 1.1.1.4.2-1]]

Date: 03/31/95

1.1.1.5 Site Features

1.1.1.6 Engineered Barriers

[Note: See Section 5.1 and Figure 1.1.1.4.2-2]

1.1.1.7 Roads

[Note: This section will present a brief description and location map(s) of the roads. Details of the roads system will be developed in Section 4.1.1.8, Onsite Transportation System. Utilize maps in Figures 1.1.1.1-1 and 1.1.1.7-1 [INN 1.1.1.7-1].]

1.1.1.8 Transportation Link

[Note: See section 4.1.1 and utilize maps in Figures 1.1.1.1-1 and 1.1.1.7-1.]

1.1.1.9 Natural System

[Note: This section will present a very brief summary of the natural system characteristics, and will be prepared after Section 3.1 is developed.]

[General Discussion]

1.1.1.9.1 Geology

[Note: See Subsection 3.1.1 and Figure 1.1.1.2-1.]

1.1.1.9.2 Hydrology

[Note: See Subsection 3.1.2 and Figure 1.1.1.9.2-1 [INN 1.1.1.9.2-1].]

1.1.1.9.3 Geochemistry

[Note: See Subsection 3.1.3 and Table 1.1.1.9.3-1 [INN 1.1.1.9.3-1].]

1.1.1.9.4 Meteorology and Climate

[Note: See Subsection 3.1.4, Table 1.1.1.9.4-1 [INN 1.1.1.9.4-1], and Figure 1.1.1.9.4-1 [INN 1.1.1.9.4-2].]

1.1.2 Design of Major Structures

[Note: See Figures 1.1.1.3-1 and 1.1.2-1 [INN 1.1.2-1], and Table 1.1.2-1 [INN 1.1.2-1].]

SKELETON TEXT

Date: 03/31/95

YMP/94-05, Rev. 0

1.1.2.1 Above Ground Structures

[Note: See Subsection 4.1.1.]

1.1.2.1.1 Permanent

1.1.2.1.2 Temporary

1.1.2.2 Below Ground Structures

[Note: See Subsections 4.1.2 and 4.1.3.]

1.1.2.2.1 Permanent

1.1.2.2.2 Temporary

1.1.3 Summary of Activities ("Plans")

1.1.3.1 Operation

[Note: See Section 7.0.]

1.1.3.2 Decommissioning

[Note: See Subsections 4.1.1.11 and 4.1.2.6.]

1.1.3.3 Permanent Closure

[Note: See Subsection 4.1.3.9.]

SKELETON TEXT

Date: 03/31/95

YMP/94-05, Rev. 0

REFERENCES

Date: 03/31/95

Table 1.1.1.9.3-1 Geochemical Features

Feature	Impact on Repository?	Discussion
Zeolite	Yes	Absorbs radionuclides, etc.

[INN 1.1.1.9.3-1]

Table 1.1.1.9.4-1 Meteorological Features

Feature	Strength	Frequency of Occurrence	Comments
Tornado	220 mph	Once every 310 years	No adverse impact (monitoring equipment adequately protected)
Thunder Storm	2 inch/hr	Once every 2 years	Enhanced drainage features (manmade). See Section____.
Hurricane	80 mph+	Once every 50 years	-----
Hail	Golf balls+	Once every 40 years	-----
Snow	16 inches or more/hr	Once every 20 years	-----
Snow	2 feet or more accumulation	Once every 15 years	-----

[INN 1.1.1.9.4-1]

TABLE TITLES

Table 1.1.2-1 Site Structures

Content: Listing of site structures (reference to Safety Analysis Section with detailed description). [INN 1.1.2-1]

FIGURE CAPTIONS

Figure 1.1.1.1-1 High-Level Waste Repository Site

Location of site, roads (improved, unimproved) and transportation links (rail lines, air access, etc.)

Show site boundary, Nevada test site, Bureau of Land Management, Nellis Air Force Base range, etc. [INN 1.1.1.1-1]

Figure 1.1.1.2-1 Geologic Setting

Geologic Map showing surface (bedrock) geology, include relief (contours).

[INN 1.1.1.2-1]

Figure 1.1.1.3-1 Site Plot Plan

Layout of GROA - Differentiate permanent and temporary facilities, include underground and above ground structures. [1.1.1.3-1]

Figure 1.1.1.4.1-1 Natural Site Boundaries

Natural site boundaries: drawings or maps - Include longitudinal cross section through proposed repository showing natural boundaries. [INN 1.1.1.4.1-1]

Figure 1.1.1.4.2-1 Manmade Boundaries

Manmade boundaries: drawings or maps [INN 1.1.1.4.2-1]

Figure 1.1.1.4.2-2 Engineered Barriers

Two views (top and cross section).

Sufficient area coverage to show all manmade barriers related to the repository, perhaps isometric graphic, also. Consider inset (or additional figure) showing wasteform encapsulation, containers, and packaging. [INN 1.1.1.4.2-1]

Figure 1.1.1.7-1 High-Level Waste Repository Site

County map

Site location

Roads and Transportation Links [INN 1.1.1.7-1]

Date: 03/31/95

FIGURE CAPTIONS (continued)

Figure 1.1.1.9.2-1 Hydrologic Features

Surface map (drainage) and cross section (unsaturated zone, saturated zone, direction of flow in aquifer with estimated rate, aquatards, playas). This will probably be a double figure, showing the same area with about a ten mile radius (map) and linear extent of the same distance along the axis of maximum flow (cross section). [INN 1.1.1.9.2-1]

Figure 1.1.1.9.4-1 Wind Rose

Show wind rose - or change reference in text to other section showing same.
[INN 1.1.1.9.4-2]

Figure 1.1.2-1 Structures

Drawing of surface and sub-surface structures. Either in one composite figure, or if needed, to clearly show structures, additional figure(s). [INN 1.1.2-1]

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.1.1.1-1
Section Number and Title:	1.1 GENERAL FACILITY DESCRIPTION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 1.1.1.1-1
Explicit description of the needed information:	Map location of site, including roads and other transportation links.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Surface facilities design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need

Information Need Number:	INN 1.1.1.2-1
Section Number and Title:	1.1 GENERAL FACILITY DESCRIPTION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 1.1.1.2-1
Explicit description of the needed information:	Map or drawings of geologic setting for the repository (general)
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.1.1.3-1
Section Number and Title:	1.1 GENERAL FACILITY DESCRIPTION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 1.1.1.3-1
Explicit description of the needed information:	Plot plan of GROA with structures identified.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Surface facilities design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.1.1.4.1-1
Section Number and Title:	1.1 GENERAL FACILITY DESCRIPTION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 1.1.1.4.1-1
Explicit description of the needed information:	Map or drawings with natural site boundaries.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Surface facilities design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.1.1.4.2-1
Section Number and Title:	1.1 GENERAL FACILITY DESCRIPTION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figures 1.1.1.4.2-1 and 1.1.1.4.2-2
Explicit description of the needed information:	Map or drawings with manmade boundaries.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Surface facilities design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.1.1.7-1
Section Number and Title:	1.1 GENERAL FACILITY DESCRIPTION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 1.1.1.7-1
Explicit description of the needed information:	Map location of site, including roads and other transportation links.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Surface facilities design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need

Information Need Number:	INN 1.1.1.9.2-1
Section Number and Title:	1.1 GENERAL FACILITY DESCRIPTION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 1.1.1.9.2-1
Explicit description of the needed information:	Diagram of hydrologic features at the site (general).
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.1.1.9.3-1
Section Number and Title:	1.1 GENERAL FACILITY DESCRIPTION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Table 1.1.1.9.3-1
Explicit description of the needed information:	Table of geochemical features at the site (general).
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.1.1.9.4-1
Section Number and Title:	1.1 GENERAL FACILITY DESCRIPTION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Table 1.1.1.9.4-1
Explicit description of the needed information:	Table of meteorological features at the site.
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.1.1.9.4-2
Section Number and Title:	1.1 GENERAL FACILITY DESCRIPTION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 1.1.1.9.4-2
Explicit description of the needed information:	Figure of wind rose at the site.
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.1.2-1
Section Number and Title:	1.1 GENERAL FACILITY DESCRIPTION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figures 1.1.2-1 and Table 1.1.2-1
Explicit description of the needed information:	List of structures on site.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	Surface facilities design group
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS License Application Annotated Outline

Section 1.2 Basis for Licensing Authority

TABLE OF CONTENTS

	Page
1.2 BASIS FOR LICENSE AUTHORITY	1.2-1
REFERENCES	1.2-4

LIST OF TABLES

LIST OF FIGURES

1.2-1 Basis for Licensing Authority-Evolution and Hierarchy of Documents [INN 1.2-1]

LIST OF INFORMATION NEEDS

1.2-1 Basis for Licensing Authority-Evolution and Hierarchy of Documents

Date: 03/31/95

1.2 BASIS FOR LICENSE AUTHORITY

Pursuant to Section 8(c) of the *Nuclear Waste Policy Act of 1982*, Public Law 97-425, DOE, as an applicant for a license to construct and operate a Mined Geologic Disposal System (MGDS), is subject to federal law and NRC regulations applicable to the siting and construction of an MGDS; and the transfer, possession, and disposal of high-level radioactive waste. The following is a chronological history of the manner in which the responsibility of final disposition of high-level waste was assigned to the DOE, and how the NRC received licensing authority for high-level waste (Figure 1.2-1) [INN 1.2-1].

An amendment to the Atomic Energy Act of 1946, identified as the Atomic Energy Act of 1954, initiated the establishment of policies to:

- Assist and foster research and development, and encourage maximum scientific and industrial progress;
- Disseminate unclassified scientific and technical information to encourage scientific and industrial progress;
- Provide government control of the possession, use, and production of atomic energy and special nuclear material owned by the government and others, to make maximum contribution to the common defense and security, and to enforce agreements with nations and groups of nations for the control of atomic weapons;
- Encourage widespread participation in the research and utilization of atomic energy for peaceful purposes to the maximum extent possible, consistent with the common defense and security, and with concern for the health and safety of the public;
- Provide a program for international cooperation to pursue the benefits of peaceful applications of atomic energy; and
- Provide a program of administration to fulfill the requirements of the Act, and to keep Congress informed if further legislative action is required on their part.

The Energy Reorganization Act of 1974, as amended, abolished the Atomic Energy Commission and repealed Sections 21 and 22 of the Atomic Energy Act of 1954, as amended (USC 2031 and 2032). All other functions, with the exception of certain items related to regulatory authority (discussed further in this section), were transferred to the newly established Energy Research and Development Administration. Pursuant to Sections 202(1) through (4), all licensing and regulatory functions of the Atomic Energy Commission were transferred to the NRC for liquid metal fast breeder reactors, demonstration nuclear reactors, facilities for the receipt and storage of high-level radioactive waste, and for retrievable subsurface storage facilities. Later, pursuant to the *Nuclear Waste Policy Act of 1982*, this authority was extended to DOE high-level waste disposal facilities. The NRC's Office of

Date: 03/31/95

Nuclear Reactor Regulation was established to license and provide regulatory oversight of facilities and materials licensed under the Atomic Energy Act of 1954. The NRC's Office of Nuclear Material Safety and Safeguards was established to provide regulatory oversight for activities associated with the processing, transport, and handling of nuclear materials and to review safety and safeguards of facilities and materials licensed under the Atomic Energy Act of 1954, as amended.

The DOE Organization Act of 1977 established the DOE as an executive branch within the federal government to promote the general welfare by ensuring a coordinated and effective administration of federal energy policy and programs. Some of the purposes of this act were to:

- Address the increasing shortage of non-renewable energy resources;
- Decrease the dependence of the U.S. on foreign energy supplies;
- Ensure that a strong national energy program is established to meet future energy demands;
- Assume responsibility for energy policy, regulation, research and development;
- Provide a comprehensive, centralized coordination and control of energy supply and conservation programs; and
- Advance the goals of restoring, protecting, and enhancing environmental quality, and ensure that public health and safety is maintained.

The NWPA provided for the development of a repository for the disposal of high-level radioactive waste and spent nuclear fuel, and established a program for the research, development, and demonstration regarding the disposal of high-level radioactive waste and spent nuclear fuel.

Congress found that a national problem had been created by the accumulation of spent nuclear fuel from nuclear reactors, radioactive waste from nuclear fuel reprocessing and from medical research and testing, and other sources. Subtitle A of the *Nuclear Waste Policy Act of 1982* assigned the federal government the responsibility to provide permanent disposal of high-level radioactive waste and spent nuclear fuel. The costs of such disposal would be the responsibility of the generators and owners of such waste and spent fuel. The owners would also have the responsibility to provide and carry the costs of interim storage until such waste is accepted by the Secretary of the DOE for permanent disposal. Subtitle A requires the Secretary to establish a schedule for the siting, construction, and operation of high-level radioactive waste repositories that will provide assurance that the public and environment are adequately protected. Five candidate sites were to be selected.

Subsequently, the NWPA redirected the nuclear waste program. This amendment designated Yucca Mountain as the only candidate site on which the DOE was to expend

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YMP/94-05, Rev. 0

Date: 03/31/95

characterization efforts. Accordingly, the Secretary directed the DOE to complete the site characterization of Yucca Mountain. [A statement similar to the following should be made in a potential LA: Following completion of the characterization of the site, the DOE has prepared and submitted this LA.]

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Date: 03/31/95

YMP/94-05, Rev. 0

REFERENCES

PL 97-425, Nuclear Waste Policy Act of 1982

42 USC 10101, Nuclear Waste Policy Amendments Act of 1987

FIGURE CAPTIONS

Figure 1.2-1 Basis for Licensing Authority-Evolution and Hierarchy of Documents

[INN 1.2-1]

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.2-1
Section Number and Title:	1.2 BASIS FOR LICENSING AUTHORITY
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 1.2-1
Explicit description of the needed information:	Basis for licensing authority diagram including the evolution and hierarchy of regulatory documents
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS License Application Annotated Outline

Section 1.3 Schedules

TABLE OF CONTENTS

	Page
1.3 SCHEDULES	1.3-1
REFERENCES	1.3-2

LIST OF TABLES

LIST OF FIGURES

- 1.3-1 Proposed Schedule for Construction [INN 1.3-1]
- 1.3-2 Proposed Schedule for Operations [INN 1.3-2]
- 1.3-3 Proposed Schedule for Receipt of Waste [INN 1.3-3]
- 1.3-4 Proposed Schedule for First Emplacement of Waste [INN 1.3-4]
- 1.3-5 Proposed Schedule for Permanent Closure [INN 1.3-5]
- 1.3-6 Proposed Overall Schedule [INN 1.3-6]

LIST OF INFORMATION NEEDS

- 1.3-1 Proposed schedule for construction.
- 1.3-2 Proposed schedule for operation.
- 1.3-3 Proposed schedule for receipt of waste.
- 1.3-4 Proposed schedule for first emplacement of waste.
- 1.3-5 Proposed schedule for permanent closure.
- 1.3-6 Proposed overall schedule.

1.3 SCHEDULES

Skeleton Text Has Not Been Developed For This Section

Text should discuss the following:

- Proposed schedules for construction (see Figure 1.3-1) [INN 1.3-1]
- Proposed schedule for operations (see Figure 1.3-2) [INN 1.3-2]
- Proposed schedule for receipt of waste (see Figure 1.3-3) [INN 1.3-3]
- Proposed schedule for first emplacement of waste (see Figure 1.3-4) [INN 1.3-4]
- Proposed schedule for permanent closure (see Figure 1.3-5) [INN 1.3-5]
- Proposed overall schedule (see Figure 1.3-6) [INN 1.3-6]
- Time requirements information from the NWPAA
- Information from DOE's mission plans
- Information from DOE's project decision schedules.

SKELETON TEXT

Date: 03/31/95

YMP/94-05, Rev. 0

REFERENCES

FIGURE CAPTIONS

Figure 1.3-1 Proposed Schedule for Construction

Graphic representation of proposed schedule for construction, including prerequisite activities, material controls, and certification(s) of completion/useability. [INN 1.3-1]

Figure 1.3-2 Proposed Schedule for Operations

Graphic representation of proposed schedule for operations, including prerequisite activities, training and qualification of personnel, etc. [INN 1.3-2]

Figure 1.3-3 Proposed Schedule for Receipt of Waste

Graphic representation of proposed schedule for receipt of waste, including prerequisite activities, completion and certification of waste container/packaging, transportation mode, surface facilities and repository, receipt and handling procedures (including quality control). [INN 1.3-3]

Figure No. 1.3-4 Proposed Schedule for First Emplacement of Waste

Graphic representation of proposed schedule for first emplacement of waste, including prerequisite activities. [INN 1.3-4]

Figure 1.3-5 Proposed Schedule for Permanent Closure

Graphic representation of proposed schedule for permanent closure of the repository, including prerequisite activities, acceptability of monitoring results, decontamination, and decommissioning of surface activities other than security and monitoring. [INN 1.3-5]

Figure 1.3-6 Proposed Overall Schedule

Graphic representation of proposed schedule for all activities associated with the repository, including completion and acceptance of design, permitting and licensing, construction, operation, decontamination, closure, and decommissioning. [INN 1.3-6]

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.3-1
Section Number and Title:	1.3 SCHEDULES
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 1.3-1
Explicit description of the needed information:	Proposed schedule for construction of repository.
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.3-2
Section Number and Title:	1.3 SCHEDULES
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 1.3-2
Explicit description of the needed information:	Proposed schedule for operation of repository.
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.3-3
Section Number and Title:	1.3 SCHEDULES
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 1.3-3
Explicit description of the needed information:	Proposed schedule for receipt of waste.
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.3-4
Section Number and Title:	1.3 SCHEDULES
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 1.3-4
Explicit description of the needed information:	Proposed schedule for first emplacement of waste.
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need

Information Need Number:	INN 1.3-5
Section Number and Title:	1.3 SCHEDULES
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 1.3-5
Explicit description of the needed information:	Proposed schedule for permanent closure of repository.
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.3-6
Section Number and Title:	1.3 SCHEDULES
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 1.3-6
Explicit description of the needed information:	Proposed overall schedule.
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS License Application Annotated Outline

Section 1.4 Certification of Safeguards

TABLE OF CONTENTS

	Page
1.4 CERTIFICATION OF SAFEGUARDS	1.4-1
REFERENCES	1.4-2

LIST OF TABLES

LIST OF FIGURES

LIST OF INFORMATION NEEDS

- 1.4-1 Names and locations of DOE surface facilities whose established safeguard programs offer protection against radiological sabotage that are considered to be suitable at the Yucca Mountain GROA.

Date: 03/31/94

1.4 CERTIFICATION OF SAFEGUARDS

Skeleton Text Has Not Been Developed For This Section [INN 1.4-1]

[A statement similar to the following should be made in a potential LA: The Safeguards needed to protect the MGDS from intrusion, sabotage, and destructive acts are described along with the Physical Security Plan (PSP) (Section 1.5) in a separate submittal.]

[In addition, a statement similar to the following should be made in a potential LA: In accordance with 10 CFR 2, *Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders*, Section 790(d), disclosure of information relating to security and facility safeguards may be withheld from the public. This section states this fact, and then it certifies that the resultant facility will contain adequate safeguards and protective security commensurate with other similar DOE surface facilities.]

REFERENCES

10 CFR 2, Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders

Date: 03/31/94

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.4-1
Section Number and Title:	1.4 CERTIFICATION OF SAFEGUARDS
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	Names and locations of DOE surface facilities whose established safeguard programs offer protection against radiological sabotage that are considered to be suitable at the Yucca Mountain GROA.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	DOE OCRWM Office of Program Management and Integration (RW-30)
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS License Application Annotated Outline

Section 1.5 Physical Security Plan

TABLE OF CONTENTS

	Page
1.5 PHYSICAL SECURITY PLAN	1.5-1
1.5.1 Design for Physical Protection	1.5-1
1.5.2 Site Location and Description	1.5-1
1.5.2.1 Site Location	1.5-1
1.5.2.2 Site Description	1.5-1
1.5.2.3 General Site Area Arrangement	1.5-1
1.5.2.4 Activities Within the Site Area Boundary	1.5-1
1.5.2.5 Early Warning Detection Systems	1.5-1
1.5.3 Design Criteria	1.5-1
1.5.4 Design Basis	1.5-2
1.5.5 PSP	1.5-2
1.5.6 Facility Description	1.5-2
1.5.6.1 Storage System Description	1.5-2
1.5.7 Facility Environs	1.5-2
1.5.7.1 Layout	1.5-2
1.5.7.2 MGDS Protected Area Perimeter and Isolation Zone	1.5-2
1.5.7.3 Illumination	1.5-2
1.5.7.4 Assessment	1.5-2
1.5.7.5 Power Systems	1.5-2
1.5.7.6 Mobile Patrols	1.5-2
1.5.7.7 MGDS Protected Area Gates	1.5-2
1.5.7.8 Access Control and Searches	1.5-2
1.5.7.9 Escorts	1.5-2
1.5.7.10 Control of Vehicles Within the MGDS Protected Area	1.5-2
1.5.7.11 Communications	1.5-2
1.5.8 Alarm Station(s)	1.5-2
1.5.8.1 Location and Layout	1.5-2
1.5.8.2 Physical Structure	1.5-2
1.5.8.3 Alarm Monitoring Hardware	1.5-2
1.5.9 Security Organization	1.5-2
1.5.10 Security Response	1.5-2
1.5.11 Local and Other Law Enforcement Agencies	1.5-2
1.5.12 Safeguards Contingencies	1.5-2
1.5.13 Background	1.5-2
1.5.13.1 MSSA	1.5-2
1.5.13.2 Perceived Danger	1.5-2
1.5.13.3 Purpose	1.5-2
1.5.13.4 Scope	1.5-2

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
1.5.14 General Planning Base	1.5-2
1.5.14.1 Event 1 Damage or Degradation of Security Barriers	1.5-2
1.5.14.2 Event 2 Loss or Degradation of MGDS Protected Area Lighting	1.5-2
1.5.14.3 Event 3 Loss or Degradation of Security Communications Systems	1.5-2
1.5.14.4 Event 4 Loss or Degradation of Intrusion Detection Hardware	1.5-2
1.5.14.5 Event 5 Loss or Degradation of Alarm Station	1.5-2
1.5.14.6 Event 6 Attempted or Confirmed Intrusion at MGDS Protected Area Perimeter	1.5-3
1.5.14.7 Event 7 Discovery of Unauthorized Personnel, Vehicles within the MGDS Protected Area	1.5-3
1.5.14.8 Event 8 Civil Disturbance	1.5-3
1.5.14.9 Event 9 Unavailability of Security Force	1.5-3
1.5.15 Licensee Planning Base	1.5-3
1.5.15.1 MGDS Management Organization	1.5-3
1.5.15.2 Local and Other Law Enforcement Agencies	1.5-3
1.5.15.3 Access Authorization	1.5-3
1.5.16 Responsibility Matrix	1.5-3
1.5.17 Security Personnel Training Program	1.5-3
1.5.18 Inspections and Tests	1.5-3
1.5.19 Inspections	1.5-3
1.5.20 Tests	1.5-3
1.5.21 Security Record Retention	1.5-3
1.5.22 Security Patrols and Inspections	1.5-3
1.5.23 Maintenance	1.5-3
1.5.24 Unescorted and Escorted Access to the MGDS Protected Area	1.5-3
1.5.24.1 Vehicles	1.5-3
1.5.24.2 Personnel	1.5-3
1.5.25 MGDS Performance Assessment Key Control	1.5-3
1.5.26 Compensatory Measures	1.5-3
1.5.27 Personnel Screening for Unescorted Access Authorization	1.5-3
1.5.28 Security Audits	1.5-3
1.5.29 Quality of the Security System	1.5-3
1.5.30 Nuclear material control and accounting program	1.5-3
1.5.31 General Description of Nuclear material control and accounting program ..	1.5-3
1.5.32 Standards for Quality Assurance of Records	1.5-4
1.5.33 Qualifications for Personnel Responsible for Program Implementation and Oversight	1.5-4
1.5.34 Audits of Records	1.5-4
1.5.35 Archiving of Records	1.5-4

TABLE OF CONTENTS (continued)

	Page
REFERENCES	1.5-5

LIST OF TABLES

LIST OF FIGURES

LIST OF INFORMATION NEEDS

1.5-1 Development of a Physical Security Plan

Date: 03/31/95

1.5 PHYSICAL SECURITY PLAN

[The (to be developed) MGDS PSP will address physical security planning, safeguards contingency planning, design for physical security, and security guard training, pursuant to 10 CFR 60.21(b)(3) and 10 CFR 60.21(b)(4). The PSP will be comparable to other DOE surface facilities' plans to promote common defense and security. The PSP will incorporate the applicable requirements of the DOE's Safeguards and Security Orders and will be designed to implement the protection program as described in the Master Safeguards and Security Agreement (MSSA) based on the vulnerability/risk analysis. [This may change and the MSSA not used based upon a current exemption request which has not been approved as of 08/25/92.] The PSP will be withheld from public disclosure, protected, and controlled in accordance with 10 CFR 2.790(d), and 10 CFR 73, *Physical Protection of Plants and Materials*, Section 21. The PSP will be submitted with the LA and made a part thereof.] [INN 1.5-1]

The plan will describe the safeguards and security program encompassing:

- a. Protection program planning/MSSA;
- b. Protection program operations;
- c. Information security program;
- d. Operations security program;
- e. Computer security program;
- f. Testing and inspection program;
- g. Security and safeguards survey and facility approval;
- h. Local law enforcement agency interface; and
- i. Nuclear material control and accounting program.

1.5.1 Design for Physical Protection

1.5.2 Site Location and Description

1.5.2.1 Site Location

1.5.2.2 Site Description

1.5.2.3 General Site Area Arrangement

1.5.2.4 Activities Within the Site Area Boundary

1.5.2.5 Early Warning Detection Systems

1.5.3 Design Criteria

Date: 03/31/95

1.5.4 Design Basis

1.5.5 PSP

1.5.6 Facility Description

1.5.6.1 Storage System Description

1.5.7 Facility Environs

1.5.7.1 Layout

1.5.7.2 MGDS Protected Area Perimeter and Isolation Zone

1.5.7.3 Illumination

1.5.7.4 Assessment

1.5.7.5 Power Systems

1.5.7.6 Mobile Patrols

1.5.7.7 MGDS Protected Area Gates

1.5.7.8 Access Control and Searches

1.5.7.9 Escorts

1.5.7.10 Control of Vehicles Within the MGDS Protected Area

1.5.7.11 Communications

1.5.8 Alarm Station(s)

1.5.8.1 Location and Layout

1.5.8.2 Physical Structure

1.5.8.3 Alarm Monitoring Hardware

1.5.9 Security Organization

1.5.10 Security Response

1.5.11 Local and Other Law Enforcement Agencies

1.5.12 Safeguards Contingencies

1.5.13 Background

1.5.13.1 MSSA

1.5.13.2 Perceived Danger

1.5.13.3 Purpose

1.5.13.4 Scope

1.5.14 General Planning Base

1.5.14.1 Event 1 Damage or Degradation of Security Barriers

1.5.14.2 Event 2 Loss or Degradation of MGDS Protected Area Lighting

1.5.14.3 Event 3 Loss or Degradation of Security Communications Systems

1.5.14.4 Event 4 Loss or Degradation of Intrusion Detection Hardware

1.5.14.5 Event 5 Loss or Degradation of Alarm Station

Date: 03/31/95

- 1.5.14.6 Event 6 Attempted or Confirmed Intrusion at MGDS Protected Area Perimeter**
 - 1.5.14.7 Event 7 Discovery of Unauthorized Personnel, Vehicles within the MGDS Protected Area**
 - 1.5.14.8 Event 8 Civil Disturbance**
 - 1.5.14.9 Event 9 Unavailability of Security Force**
- 1.5.15 Licensee Planning Base**
 - 1.5.15.1 MGDS Management Organization**
 - 1.5.15.2 Local and Other Law Enforcement Agencies**
 - 1.5.15.3 Access Authorization**
- 1.5.16 Responsibility Matrix**
- 1.5.17 Security Personnel Training Program**
- 1.5.18 Inspections and Tests**
- 1.5.19 Inspections**
- 1.5.20 Tests**
- 1.5.21 Security Record Retention**
- 1.5.22 Security Patrols and Inspections**
- 1.5.23 Maintenance**
- 1.5.24 Unescorted and Escorted Access to the MGDS Protected Area**
 - 1.5.24.1 Vehicles**
 - 1.5.24.2 Personnel**
- 1.5.25 MGDS Performance Assessment Key Control**
- 1.5.26 Compensatory Measures**
- 1.5.27 Personnel Screening for Unescorted Access Authorization**
- 1.5.28 Security Audits**
- 1.5.29 Quality of the Security System**
- 1.5.30 Nuclear material control and accounting program**
- 1.5.31 General Description of Nuclear material control and accounting program**

Date: 03/31/95

1.5.32 Standards for Quality Assurance of Records

1.5.33 Qualifications for Personnel Responsible for Program Implementation and Oversight

1.5.34 Audits of Records

1.5.35 Archiving of Records

REFERENCES

10 CFR 60, Disposal of High-Level Radioactive Wastes in Geologic Repositories

10 CFR 2, Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders

DOE Order 5630.11, Safeguards and Security Program

10 CFR 73, Physical Protection of Plants and Materials

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need

Information Need Number:	INN 1.5-1
Section Number and Title:	1.5 PHYSICAL SECURITY PLAN
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	The development of a PSP.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

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Date: 03/31/95

YMP/94-05, Rev.0

MGDS License Application Annotated Outline

Section 1.6 Site Characterization Program Review

Date: 03/31/95

TABLE OF CONTENTS

	Page
1.6 SITE CHARACTERIZATION PROGRAM REVIEW	1.6-1
1.6.1 Site Characterization Work Conducted	1.6-1
1.6.1.1 Summary of Site Characterization Work	1.6-2
1.6.1.1.1 Site Program (SCP Sec. 8.3.1)	1.6-2
1.6.1.1.1.1 Geohydrology (SCP Sec. 8.3.1.2)	1.6-2
1.6.1.1.1.1.1 Investigation: Studies to provide a description of the regional hydrologic system (SCP Sec. 8.3.1.2.1) ...	1.6-2
1.6.1.1.1.1.1.1 Study: Characterization of the meteorology for the regional hydrology	1.6-2
1.6.1.1.1.1.1.2 Study: Characterization of runoff and streamflow (SCP Sec. 8.3.1.2.1.2)	1.6-3
1.6.1.1.1.1.1.3 Study: Characterization of the regional ground-water flow system (SCP Sec. 8.3.1.1.1.3)	1.6-3
1.6.1.1.1.1.1.4 Study: Regional hydrologic system synthesis and modeling (SCP Sec. 8.3.1.1.1.4)	1.6-3
1.6.1.1.1.1.2 Investigation: Studies to provide a description of the unsaturated zone hydrologic system at the site. (SCP Sec. 8.3.1.2.2)	1.6-3
1.6.1.1.1.1.2.1 Study: Characterization of unsaturated-zone infiltration (SCP Sec. 8.3.1.2.2.1)	1.6-3
1.6.1.1.1.1.2.2 Study: Water movement tracer tests using chloride and chlorine-36 measurements of percolation at Yucca Mountain (SCP Sec. 8.3.1.2.2.2)	1.6-4
1.6.1.1.1.1.2.3 Study: Characterization of Yucca Mountain percolation in the unsaturated zone exploratory facility study (SCP Sec. 8.3.1.2.2.4)	1.6-4
1.6.1.1.1.1.2.4 Study: Diffusion tests on the ESF (SCP Sec. 8.3.2.2.5)	1.6-4
1.6.1.1.1.1.2.5 Study: Characterization of gaseous-phase movement in the saturated zone (SCP Sec. 8.3.1.2.2.6)	1.6-4
1.6.1.1.1.1.2.6 Study: Hydrochemical characterization of the unsaturated zone (SCP Sec. 8.3.1.2.2.7)	1.6-5
1.6.1.1.1.1.2.7 Study: Fluid Flow in Unsaturated Fractured Rock (SCP Sec. 8.3.1.2.8)	1.6-5
1.6.1.1.1.1.2.8 Study: Site Unsaturated-zone Modeling and Synthesis (SCP Sec. 8.3.1.2.2.9)	1.6-5
1.6.1.1.1.1.3 Investigation: Studies to provide a description of the saturated zone hydrologic systems (SCP Sec. 8.3.1.2.3)	1.6-5
1.6.1.1.1.2 Geochemistry (SCP 8.3.1.3)	1.6-5

SKELETON TEXT

YMP/94-05, Rev.0

Date: 03/31/95

1.6.1.1.1.2.1	Investigation: Studies to provide information on water chemistry within the potential emplacement horizon and along flow paths (SCP Sec. 8.3.1.3.1) .	1.6-5
1.6.1.1.1.2.2	Investigation: Studies to provide information on mineralogy, petrology, and rock chemistry within the potential emplacement horizon and along flow paths (SCP Sec. 8.3.1.3.2)	1.6-5
1.6.1.1.1.2.3	Investigation: Studies to provide information required on stability of minerals and glasses (SCP Sec. 8.3.1.3.3)	1.6-6
1.6.1.1.1.2.4	Investigation: Studies to provide the information required on radionuclide retardation by sorption processes along flow paths to the accessible environment (SCP Sec. 8.3.1.3.4)	1.6-6
1.6.1.1.1.2.5	Investigation: Studies to provide the information required on radionuclide retardation by precipitation processes along flow paths to accessible environment (SCP Sec. 8.3.1.3.5)	1.6-6
1.6.1.1.1.2.6	Investigation: Studies to provide the information on radionuclide retardation by dispersive, diffusive, and advective transport processes along flow paths to the accessible environment (SCP Sec. 8.3.1.3.6)	1.6-6
1.6.1.1.1.2.7	Investigation: Studies to provide the information required on radionuclide retardation by all processes along flow paths to the accessible environment (SCP Sec. 8.3.1.3.7)	1.6-6
1.6.1.1.1.2.8	Investigation: Studies to provide the required information on retardation of gaseous radionuclides along flow paths to the accessible environment (SCP Sec. 8.3.1.3.8)	1.6-6
1.6.1.1.1.3	Rock Characteristics (SCP Sec. 8.3.1.4)	1.6-6
1.6.1.1.1.3.1	Investigation: Studies to develop an integrated drilling program and integration of geophysical activities (SCP Sec. 8.3.1.4.1)	1.6-6
1.6.1.1.1.3.2	Investigation: Studies on the geologic framework of the Yucca Mountain Site (SCP Sec. 8.3.1.4.2)	1.6-6
1.6.1.1.1.3.3	Investigation: Investigation of three dimensional models of rock characteristics at the repository site (SCP Sec. 8.3.1.4.3)	1.6-6
1.6.1.1.1.4	Climate Program (SCP Sec. 8.3.1.5)	1.6-6
1.6.1.1.1.4.1	Investigation: Studies to provide the information required on nature and rates of change in climatic conditions to predict future climates (SCP Sec. 8.3.1.5.1)	1.6-6

SKELETON TEXT

YMP/94-05, Rev.0

Date: 03/31/95

1.6.1.1.1.4.2	Investigation: Studies to provide the information required on the potential effects of future climatic conditions on hydrologic characteristics (SCP Sec. 8.3.1.5.2)	1.6-6
1.6.1.1.1.5	Erosion (SCP Sec. 8.3.1.6)	1.6-6
1.6.1.1.1.5.1	Investigation: Studies to determine to determine present locations and rates of surface erosion (SCP Sec. 8.3.1.6.1)	1.6-7
1.6.1.1.1.5.2	Investigation: Potential effects of future climatic conditions on locations and rates of erosion (SCP Sec. 8.3.1.6.2)	1.6-7
1.6.1.1.1.5.3	Investigation: Studies to provide the information required to determine the potential effects of future tectonic activity on locations and rates of erosion (SCP Sec. 8.3.1.6.3)	1.6-7
1.6.1.1.1.5.4	Investigation: Potential effects of erosion on hydrologic, geochemical, and rock characteristics (SCP Sec. 8.3.1.6.4)	1.6-7
1.6.1.1.1.6	Rock Dissolution (SCP Sec. 8.3.1.7)	1.6-7
1.6.1.1.1.6.1	Investigation: Rates of dissolution of crystalline and noncrystalline components in tuff (SCP Sec. 8.3.1.7.1)	1.6-7
1.6.1.1.1.7	Tectonics (SCP Sec. 8.3.1.8)	1.6-7
1.6.1.1.1.7.1	Investigation: Studies to provide information required on direct releases resulting from volcanic activity (SCP Sec. 8.3.1.8.1)	1.6-7
1.6.1.1.1.7.2	Investigation: Studies to provide information required on rupture of waste packages due to tectonic events (SCP Sec. 8.3.1.8.2)	1.6-7
1.6.1.1.1.7.3	Investigations: Studies to provide information required on changes in unsaturated and saturated zone hydrology due to tectonic events (SCP Sec.8.3.1.8.3)	1.6-7
1.6.1.1.1.7.4	Investigation: Studies to provide information required on changes in rock geochemical properties resulting from tectonic processes (SCP Sec. 8.3.1.8.4)	1.6-7
1.6.1.1.1.7.5	Investigation: Studies to provide the information required by the analysis and assessment investigations of the tectonics program (SCP Sec. 8.3.1.8.5)	1.6-7
1.6.1.1.1.8	Human Interference (SCP Sec. 8.3.1.9)	1.6-7

Date: 03/31/95

1.6.1.1.1.8.1	Investigation: Studies to provide the information required on natural phenomena and human activities that might degrade surface markers and monuments (SCP Sec. 8.3.1.9.1)	1.6-7
1.6.1.1.1.8.2	Investigation: Studies to provide the information required on present and future value of energy, mineral, land, and groundwater resources (Sec. 8.3.1.9.2)	1.6-8
1.6.1.1.1.8.3	Investigation: Studies to provide the information required on potential effects of exploiting natural resources on hydrologic, geochemical, and rock characteristics (Sec. 8.3.1.9.3)	1.6-8
1.6.1.1.1.9	Population (SCP Sec. 8.3.1.10)	1.6-8
1.6.1.1.1.10	Land Ownership (SCP Sec. 8.3.1.11) (See Chapter 9 of the Safety Analysis Report)	1.6-8
1.6.1.1.1.11	Meteorology (SCP Sec. 8.3.1.12)	1.6-8
1.6.1.1.1.11.1	Investigation: Studies to provide data on regional meteorological conditions (SCP Sec. 8.3.1.12.1) . . .	1.6-8
1.6.1.1.1.11.2	Investigation: Studies to provide data on atmospheric and meteorological phenomena at potential locations of surface facilities (SCP Sec. 8.3.1.12.2)	1.6-8
1.6.1.1.1.11.3	Investigation to provide data on the location of population centers relative to wind patterns in the general region of the site (SCP Sec. 8.3.1.12.3) . . .	1.6-8
1.6.1.1.1.11.4	Investigation: Studies to provide data on potential extreme weather phenomena and their recurrence intervals (SCP Sec. 8.3.1.12.4)	1.6-8
1.6.1.1.1.12	Offsite Installation and Operations Program (SCP Sec. 8.3.1.13)	1.6-8
1.6.1.1.1.12.1	Investigation: Determination of nearby industrial, transportation, and military installations and operations (nuclear and nonnuclear) (SCP Sec. 8.3.1.13.1)	1.6-8
1.6.1.1.1.12.2	Investigation: Potential impacts of nearby installations and operations (SCP Sec. 8.3.1.13.2) . .	1.6-8
1.6.1.1.1.13	Surface Characteristics (SCP Sec. 8.3.1.14)	1.6-8
1.6.1.1.1.13.1	Investigation: Studies to provide the topographic characteristics of potential locations of surface facilities (SCP Sec. 8.3.1.14.1)	1.6-8
1.6.1.1.1.13.2	Investigation: Studies to provide soil and rock properties of potential locations of surface facilities (SCP Sec. 8.3.1.14.2)	1.6-9
1.6.1.1.1.14	Thermal And Mechanical Rock Properties (SCP Sec. 8.3.1.15)	1.6-9

SKELETON TEXT

Date: 03/31/95

YMP/94-05, Rev.0

1.6.1.1.1.14.1	Studies to provide the required information for spatial distribution of thermal and mechanical properties (SCP Sec. 8.3.1.15.1)	1.6-9
1.6.1.1.1.14.2	Studies to provide the required information for spatial distribution of ambient stress and thermal conditions (SCP Sec. 8.3.1.15.2)	1.6-9
1.6.1.1.1.15	Preclosure Hydrology Program (SCP Sec. 8.3.1.16)	1.6-9
1.6.1.1.1.15.1	Investigation: Flood recurrence intervals and levels at potential locations surface facilities (SCP Sec. 8.3.1.16.1)	1.6-9
1.6.1.1.1.15.2	Investigation: Location of adequate water supplies (SCP Sec. 8.3.1.16.2)	1.6-9
1.6.1.1.1.15.3	Investigation: Ground-water conditions within and above the potential host rock (SCP Sec. 8.3.1.16.3)	1.6-9
1.6.1.1.1.16	Preclosure Tectonics (SCP Sec. 8.3.1.17)	1.6-9
1.6.1.1.1.16.1	Investigation: Studies to provide required information on volcanic activity that could affect repository design or performance (SCP Sec. 8.3.1.17.1)	1.6-9
1.6.1.1.1.16.2	Investigation: Studies to provide required information on fault displacement that could affect repository design or performance (SCP Sec. 8.3.1.17.2)	1.6-9
1.6.1.1.1.16.3	Investigation: Studies to provide required information on vibratory ground motion that could affect repository design or performance (SCP Sec. 8.3.1.17.3)	1.6-9
1.6.1.1.1.16.4	Investigation: Preclosure tectonics data collection and analysis (SCP Sec. 8.3.1.17.4)	1.6-9
1.6.1.1.2	Repository Program (SCP Sec. 8.3.2)	1.6-9
1.6.1.1.3	Seal Program (SCP Sec. 8.3.3)	1.6-9
1.6.1.1.4	Waste Package Program (SCP Sec. 8.3.4)	1.6-9
1.6.1.1.5	Performance Assessment Program (SCP Sec. 8.3.5)	1.6-10
1.6.1.2	Differences Between Characterization Work and the SCP	1.6-10
1.6.2	Status of DOE Resolution of NRC Objections	1.6-10
REFERENCES	. . . . .	1.6-11

SKELETON TEXT

Date: 03/31/95

YMP/94-05, Rev.0

LIST OF TABLES

1.6.1.2-1 SCP Program Changes [INN 1.6.1.2-1]

LIST OF FIGURES

LIST OF INFORMATION NEEDS

INN 1.6.1.2-1 A summary report on differences between work performed and work described in the SCP. The information is preferred to be provided in a table.

Date: 03/31/95

1.6 SITE CHARACTERIZATION PROGRAM REVIEW

1.6.1 Site Characterization Work Conducted

The purpose of this section is to summarize the site characterization work conducted at the Yucca Mountain site. [The characterization will be conducted for the purposes of developing the design of the repository and the waste package; demonstrating the suitability of the site for a repository; preparing an environmental impact statement; and obtaining from the NRC an authorization to construct the repository with this LA.]

The SCP was developed in accordance with the requirements of the *Nuclear Waste Policy Act of 1982* and the regulations promulgated by the NRC in 10 CFR 60. The SCP includes a description of the Yucca Mountain Site, a conceptual design for the repository, a description of the packaging to be used for the waste to be emplaced in the repository, and a description of the planned site characterization.

The SCP is divided into two parts: Part A consists of Chapters 1 through 7, and provides a description of the site, the waste package, and the repository design; Part B consists of Chapter 8 and presents the DOE's plans for the site characterization program.

During site characterization, the DOE reported every six months to the NRC, as well as to the governor and the legislature of the state of Nevada, on the nature and extent of site characterization activities, the information developed from such activities, and the progress on waste form and waste package research and development. These reports included the results of site characterization studies, the identification of new issues, plans for additional studies to resolve new issues, the identification of decision points reached, and modifications to schedules where appropriate. The reports also described progress in developing the repository design, noting when key design parameters or features that depend on the results of site characterization will be established.

The SCP was issued on December 28, 1988. The public comment period for the SCP expired on June 1, 1989. The DOE received comments from the NRC on July 31, 1989, and from the state of Nevada on May 30, 1989, and September 1, 1989. Comments were also received from other federal agencies, interested parties, and the general public. All SCP comments were evaluated, and responses to the comments have been made. Formal responses have been published for the following organizations's comments:

- California Energy Commission
- Environmental Protection Agency
- Edison Electric Institute
- U. S. Department of Interior
- State Of Nevada
- Lincoln County Board of Commissioners.

Date: 03/31/95

The reports which present these responses to comments are listed with references for this section.

1.6.1.1 Summary of Site Characterization Work

This subsection summarizes the DOE's site characterization program actually conducted at the Yucca Mountain Site.

[NOTE: Work to be conducted as described in the SCP and its study plans will be summarized here. Those summaries will be revised to reflect actual work performed after it is completed.]

1.6.1.1.1 Site Program (SCP Sec. 8.3.1)

The site program was designed and performed to acquire the information about the site that is needed to resolve the design and performance issues.

1.6.1.1.1.1 Geohydrology (SCP Sec. 8.3.1.2)

This section presents a summary of the site characterization of the regional and local geohydrology. The program was developed and designed to understand the present and expected geohydrologic characteristics of each of the saturated and unsaturated flow regimes, and of the gaseous and water-vapor flow processes.

1.6.1.1.1.1.1 Investigation: Studies to provide a description of the regional hydrologic system (SCP Sec. 8.3.1.2.1)**1.6.1.1.1.1.1.1 Study: Characterization of the meteorology for the regional hydrology**

Activity: Precipitation and meteorological monitoring. (SCP Sec. 8.3.1.2.1.1.1)

[The precipitation and meteorological monitoring study will be conducted to provide site specific information on precipitation at and near the network streamflow measurement sites.]

The parameters for the study are as follows:

- Precipitation amounts
- Surface temperatures
- Atmospheric pressure and pressure variability
- Relative humidity and diurnal humidity cycles and a seasonal variability
- Incoming and outgoing short wave radiation and its diurnal and seasonal variability
- Wind speed and direction and diurnal, seasonal, and storm-specific variability

The activities conducted to collect these parameters include: [To be added]

Date: 03/31/95

1.6.1.1.1.1.2 Study: Characterization of runoff and streamflow (SCP Sec. 8.3.1.2.1.2)

- a. Activity: Surface runoff monitoring
- b. Activity: Transport of debris by severe runoff (SCP Sec. 8.3.1.2.1.2.2)

1.6.1.1.1.1.3 Study: Characterization of the regional ground-water flow system (SCP Sec. 8.3.1.1.1.3)

- a. Activity: Assessment of the regional hydrogeological data needs in the saturated zone. (SCP Sec. 8.3.1.2.1.3.1)
- b. Activity: Regional potentiometric-level distribution and hydrogeologic framework studies (SCP Sec. 8.3.1.2.1.3.2)
- c. Activity: Fortymile Wash recharge study (SCP Sec. 8.3.1.2.1.3.3)
- d. Activity: Evaporatranspiration studies (SCP Sec. 8.3.1.2.3.4).

1.6.1.1.1.1.4 Study: Regional hydrologic system synthesis and modeling (SCP Sec. 8.3.1.1.1.4)

- a. Activity: Conceptualization of regional hydrologic flow models (SCP Sec. 8.3.1.1.1.4.1)
- b. Activity: Subregional two-dimensional areal hydrologic modeling (SCP Sec. 8.3.1.2.1.4.2)
- c. Activity: Subregional two-dimensional cross section hydrologic modeling (SCP Sec. 8.3.1.2.1.4.3)
- d. Activity: Regional three-dimensional hydrologic modeling (SCP Sec. 8.3.1.2.1.4.4).

1.6.1.1.1.2 Investigation: Studies to provide a description of the unsaturated zone hydrologic system at the site. (SCP Sec. 8.3.1.2.2)**1.6.1.1.1.2.1 Study: Characterization of unsaturated-zone infiltration (SCP Sec. 8.3.1.2.2.1)**

- a. Activity: Characterization of hydrologic properties of surficial materials (SCP Sec. 8.3.1.2.2.1.1)
- b. Activity: Evaluation of natural infiltration (SCP Sec. 8.3.1.2.2.1.2)
- c. Activity: Evaluation of artificial infiltration (SCP Sec. 8.3.1.2.2.1.3).

Date: 03/31/95

1.6.1.1.1.2.2 Study: Water movement tracer tests using chloride and chlorine-36 measurements of percolation at Yucca Mountain (SCP Sec. 8.3.1.2.2.2)

- a. Activity: Matrix hydrologic properties testing (SCP 8.3.1.2.2.3.1)
- b. Activity: Site vertical borehole studies (SCP Sec. 8.3.1.2.2.3.2)
- c. Activity: Solitario Canyon horizontal borehole study (SCP Study 8.3.1.2.2.3).

1.6.1.1.1.2.3 Study: Characterization of Yucca Mountain percolation in the unsaturated zone exploratory facility study (SCP Sec. 8.3.1.2.2.4)

- a. Activity: Intact-fracture test in the ESF SCP Sec. 8.3.1.2.2.4.1)
- b. Activity: Percolation tests in the ESF (SCP Sec. 8.3.1.2.2.4.2)
- c. Activity: Bulk-permeability test in the ESF (SCP Sec. 8.3.1.2.2.4.3)
- d. Activity: Radial borehole tests in the ESF (SCP Sec. 8.3.1.2.2.4.4)
- e. Activity: Excavation effects test in the ESF SCP Sec. 8.3.1.2.2.4.5)
- f. Activity: Calico Hills testing in the ESF (SCP Sec. 8.3.1.2.2.4.6)
- g. Activity: Perched water test in the ESF (SCP Sec. 8.3.1.2.2.4.7)
- h. Activity: Hydrochemistry tests in the ESF (SCP Sec. 8.3.1.2.2.4.8)
- i. Activity: Multi purpose borehole testing (SCP Sec. 8.3.1.2.2.4.9)
- j. Activity: Hydrologic properties of major faults encountered on main test level of the ESF (SCP 8.3.1.2.2.4.10).

1.6.1.1.1.2.4 Study: Diffusion tests on the ESF (SCP Sec. 8.3.2.2.5)

Activity: Diffusion tests in the ESF (SCP Sec. 8.3.1.2.2.5.1)

1.6.1.1.1.2.5 Study: Characterization of gaseous-phase movement in the saturated zone (SCP Sec. 8.3.1.2.2.6)

Activity: Gaseous-phase circulation study (SCP Sec. 8.3.1.2.2.6.1)

SKELETON TEXT

Date: 03/31/95

YMP/94-05, Rev.0

1.6.1.1.1.2.6 Study: Hydrochemical characterization of the unsaturated zone (SCP Sec. 8.3.1.2.2.7)

- a. Activity: Gaseous-phase chemical investigations (SCP Sec. 8.3.1.2.2.7.1)
- b. Activity: Aqueous-phase chemical investigations (SCP Sec. 8.3.1.2.2.7.2).

1.6.1.1.1.2.7 Study: Fluid Flow in Unsaturated Fractured Rock (SCP Sec. 8.3.1.2.2.8)

- a. Activity: Development of conceptual and numerical models of fluid flow in unsaturated, fractured rock (SCP Sec. 8.3.1.2.2.8.1).
- b. Activity: Validation of conceptual and numerical models of fluid flow through unsaturated, fractured rock (SCP Sec. 8.3.1.2.2.8.2)

1.6.1.1.1.2.8 Study: Site Unsaturated-zone Modeling and Synthesis (SCP Sec. 8.3.1.2.2.9)

- a. Activity: Conceptualization of the unsaturated zone hydrogeologic system (SCP Sec. 8.3.1.2.2.9.1)
- b. Activity: Selection, development, and testing of hydrologic-modeling computer codes (SCP Sec. 8.3.1.2.2.9.2)
- c. Activity: Simulation of the natural hydrogeological system (SCP Sec. 8.3.1.2.2.9.3)
- d. Activity: Stochastic modeling and uncertainty analysis (SCP Sec. 8.3.1.2.2.9.4)
- e. Activity: Site unsaturated zone integration and synthesis (SCP 8.3.1.2.2.9.5).

1.6.1.1.1.3 Investigation: Studies to provide a description of the saturated zone hydrologic systems (SCP Sec. 8.3.1.2.3)

1.6.1.1.1.2 Geochemistry (SCP 8.3.1.3)

1.6.1.1.1.2.1 Investigation: Studies to provide information on water chemistry within the potential emplacement horizon and along flow paths (SCP Sec. 8.3.1.3.1)

1.6.1.1.1.2.2 Investigation: Studies to provide information on mineralogy, petrology, and rock chemistry within the potential emplacement horizon and along flow paths (SCP Sec. 8.3.1.3.2)

SKELETON TEXT

YMP/94-05, Rev.0

Date: 03/31/95

- 1.6.1.1.1.2.3** **Investigation: Studies to provide information required on stability of minerals and glasses (SCP Sec. 8.3.1.3.3)**
- 1.6.1.1.1.2.4** **Investigation: Studies to provide the information required on radionuclide retardation by sorption processes along flow paths to the accessible environment (SCP Sec. 8.3.1.3.4)**
- 1.6.1.1.1.2.5** **Investigation: Studies to provide the information required on radionuclide retardation by precipitation processes along flow paths to accessible environment (SCP Sec. 8.3.1.3.5)**
- 1.6.1.1.1.2.6** **Investigation: Studies to provide the information on radionuclide retardation by dispersive, diffusive, and advective transport processes along flow paths to the accessible environment (SCP Sec. 8.3.1.3.6)**
- 1.6.1.1.1.2.7** **Investigation: Studies to provide the information required on radionuclide retardation by all processes along flow paths to the accessible environment (SCP Sec. 8.3.1.3.7)**
- 1.6.1.1.1.2.8** **Investigation: Studies to provide the required information on retardation of gaseous radionuclides along flow paths to the accessible environment (SCP Sec. 8.3.1.3.8)**
- 1.6.1.1.1.3** **Rock Characteristics (SCP Sec. 8.3.1.4)**
- 1.6.1.1.1.3.1** **Investigation: Studies to develop an integrated drilling program and integration of geophysical activities (SCP Sec. 8.3.1.4.1)**
- 1.6.1.1.1.3.2** **Investigation: Studies on the geologic framework of the Yucca Mountain Site (SCP Sec. 8.3.1.4.2)**
- 1.6.1.1.1.3.3** **Investigation: Investigation of three dimensional models of rock characteristics at the repository site (SCP Sec. 8.3.1.4.3)**
- 1.6.1.1.1.4** **Climate Program (SCP Sec. 8.3.1.5)**
- 1.6.1.1.1.4.1** **Investigation: Studies to provide the information required on nature and rates of change in climatic conditions to predict future climates (SCP Sec. 8.3.1.5.1)**
- 1.6.1.1.1.4.2** **Investigation: Studies to provide the information required on the potential effects of future climatic conditions on hydrologic characteristics (SCP Sec. 8.3.1.5.2)**
- 1.6.1.1.1.5** **Erosion (SCP Sec. 8.3.1.6)**

SKELETON TEXT

Date: 03/31/95

YMP/94-05, Rev.0

- 1.6.1.1.1.5.1** **Investigation: Studies to determine to determine present locations and rates of surface erosion (SCP Sec. 8.3.1.6.1)**
- 1.6.1.1.1.5.2** **Investigation: Potential effects of future climatic conditions on locations and rates of erosion (SCP Sec. 8.3.1.6.2)**
- 1.6.1.1.1.5.3** **Investigation: Studies to provide the information required to determine the potential effects of future tectonic activity on locations and rates of erosion (SCP Sec. 8.3.1.6.3)**
- 1.6.1.1.1.5.4** **Investigation: Potential effects of erosion on hydrologic, geochemical, and rock characteristics (SCP Sec. 8.3.1.6.4)**
- 1.6.1.1.1.6** **Rock Dissolution (SCP Sec. 8.3.1.7)**
- 1.6.1.1.1.6.1** **Investigation: Rates of dissolution of crystalline and noncrystalline components in tuff (SCP Sec. 8.3.1.7.1)**
- 1.6.1.1.1.7** **Tectonics (SCP Sec. 8.3.1.8)**
- 1.6.1.1.1.7.1** **Investigation: Studies to provide information required on direct releases resulting from volcanic activity (SCP Sec. 8.3.1.8.1)**
- 1.6.1.1.1.7.2** **Investigation: Studies to provide information required on rupture of waste packages due to tectonic events (SCP Sec. 8.3.1.8.2)**
- 1.6.1.1.1.7.3** **Investigations: Studies to provide information required on changes in unsaturated and saturated zone hydrology due to tectonic events (SCP Sec.8.3.1.8.3)**
- 1.6.1.1.1.7.4** **Investigation: Studies to provide information required on changes in rock geochemical properties resulting from tectonic processes (SCP Sec. 8.3.1.8.4)**
- 1.6.1.1.1.7.5** **Investigation: Studies to provide the information required by the analysis and assessment investigations of the tectonics program (SCP Sec. 8.3.1.8.5)**
- 1.6.1.1.1.8** **Human Interference (SCP Sec. 8.3.1.9)**
- 1.6.1.1.1.8.1** **Investigation: Studies to provide the information required on natural phenomena and human activities that might degrade surface markers and monuments (SCP Sec. 8.3.1.9.1)**

Date: 03/31/95

- 1.6.1.1.1.8.2** **Investigation: Studies to provide the information required on present and future value of energy, mineral, land, and groundwater resources (Sec. 8.3.1.9.2)**
- 1.6.1.1.1.8.3** **Investigation: Studies to provide the information required on potential effects of exploiting natural resources on hydrologic, geochemical, and rock characteristics (Sec. 8.3.1.9.3)**
- 1.6.1.1.1.9** **Population (SCP Sec. 8.3.1.10)**
- 1.6.1.1.1.10** **Land Ownership (SCP Sec. 8.3.1.11) (See Chapter 9 of the Safety Analysis Report)**
- 1.6.1.1.1.11** **Meteorology (SCP Sec. 8.3.1.12)**
- 1.6.1.1.1.11.1** **Investigation: Studies to provide data on regional meteorological conditions (SCP Sec. 8.3.1.12.1)**
- 1.6.1.1.1.11.2** **Investigation: Studies to provide data on atmospheric and meteorological phenomena at potential locations of surface facilities (SCP Sec. 8.3.1.12.2)**
- 1.6.1.1.1.11.3** **Investigation to provide data on the location of population centers relative to wind patterns in the general region of the site (SCP Sec. 8.3.1.12.3)**
- 1.6.1.1.1.11.4** **Investigation: Studies to provide data on potential extreme weather phenomena and their recurrence intervals (SCP Sec. 8.3.1.12.4)**
- 1.6.1.1.1.12** **Offsite Installation and Operations Program (SCP Sec. 8.3.1.13)**
- 1.6.1.1.1.12.1** **Investigation: Determination of nearby industrial, transportation, and military installations and operations (nuclear and nonnuclear) (SCP Sec. 8.3.1.13.1)**
- 1.6.1.1.1.12.2** **Investigation: Potential impacts of nearby installations and operations (SCP Sec. 8.3.1.13.2)**
- 1.6.1.1.1.13** **Surface Characteristics (SCP Sec. 8.3.1.14)**
- 1.6.1.1.1.13.1** **Investigation: Studies to provide the topographic characteristics of potential locations of surface facilities (SCP Sec. 8.3.1.14.1)**

SKELETON TEXT

YMP/94-05, Rev.0

Date: 03/31/95

- 1.6.1.1.1.13.2** **Investigation: Studies to provide soil and rock properties of potential locations of surface facilities (SCP Sec. 8.3.1.14.2)**
- 1.6.1.1.1.14** **Thermal And Mechanical Rock Properties (SCP Sec. 8.3.1.15)**
- 1.6.1.1.1.14.1** **Studies to provide the required information for spatial distribution of thermal and mechanical properties (SCP Sec. 8.3.1.15.1)**
- 1.6.1.1.1.14.2** **Studies to provide the required information for spatial distribution of ambient stress and thermal conditions (SCP Sec. 8.3.1.15.2)**
- 1.6.1.1.1.15** **Preclosure Hydrology Program (SCP Sec. 8.3.1.16)**
- 1.6.1.1.1.15.1** **Investigation: Flood recurrence intervals and levels at potential locations surface facilities (SCP Sec. 8.3.1.16.1)**
- 1.6.1.1.1.15.2** **Investigation: Location of adequate water supplies (SCP Sec. 8.3.1.16.2)**
- 1.6.1.1.1.15.3** **Investigation: Ground-water conditions within and above the potential host rock (SCP Sec. 8.3.1.16.3)**
- 1.6.1.1.1.16** **Preclosure Tectonics (SCP Sec. 8.3.1.17)**
- 1.6.1.1.1.16.1** **Investigation: Studies to provide required information on volcanic activity that could affect repository design or performance (SCP Sec. 8.3.1.17.1)**
- 1.6.1.1.1.16.2** **Investigation: Studies to provide required information on fault displacement that could affect repository design or performance (SCP Sec. 8.3.1.17.2)**
- 1.6.1.1.1.16.3** **Investigation: Studies to provide required information on vibratory ground motion that could affect repository design or performance (SCP Sec. 8.3.1.17.3)**
- 1.6.1.1.1.16.4** **Investigation: Preclosure tectonics data collection and analysis (SCP Sec. 8.3.1.17.4)**
- 1.6.1.1.2** **Repository Program (SCP Sec. 8.3.2)**
- 1.6.1.1.3** **Seal Program (SCP Sec. 8.3.3)**
- 1.6.1.1.4** **Waste Package Program (SCP Sec. 8.3.4)**

SKELETON TEXT

Date: 03/31/95

YMP/94-05, Rev.0

1.6.1.1.5 Performance Assessment Program (SCP Sec. 8.3.5)

1.6.1.2 Differences Between Characterization Work and the SCP

[If the characterization work conducted differs from the SCP, a statement similar to the following will be made: Portions of the site characterization work conducted differed from the work described in the SCP. These changes were generally the result of additional information providing different direction or design considerations. These changes have been reported semiannually in progress reports and in the study report. Table 1.6.1.2-1 [INN 1.6.1.2-1] lists the changes in the program. The table identifies the area in the SCP that the work occurred, the cause of the change, and if the change has not been previously reported.] [INN 1.6.1.2-1]

1.6.2 Status of DOE Resolution of NRC Objections

No Skeleton Text Developed.

REFERENCES

DOE/RW-0199, Site Characterization Plan, Yucca Mountain Site, Nevada Research and Development Area, Nevada

DOE/RW-0217P, Progress Report on the Scientific Investigation Program for the Nevada Yucca Mountain Site, September 15, 1988 - August 15, 1989, April 16 - September 30, 1989, Washington DC.

YMP/90-97, Responses to California Energy Commission Comments on the Site Characterization Plan

YMP/90-103, Responses to Lincoln County Board of Commissioners' Comments on the Site Characterization Plan

YMP/90-101, Responses to Environmental Protection Agency Comments on the Site Characterization Plan

YMP/90-99, Responses to Edison Electric Institute Comments on the Site Characterization Plan

YMP/90-98, Responses to U.S. Department of Interior Comments on the Site Characterization Plan

NUREG-1347, NRC Staff Site Characterization, Analysis of the Department of Energy's Site Characterization Plan, Yucca Mountain Site, Nevada.

SKELETON TEXT

YMP/94-05, Rev.0

Date: 03/31/95

Table 1.6.1.2-1 SCP Program Changes

SCP Section	SCP Activity	Change of Activity	Cause of Activity Change	Result of Activity Change	Previously Reported	Remarks
8.1.1X						

[INN 1.6.1.2-1]

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.6.1.2-1
Section Number and Title:	1.6 SITE CHARACTERIZATION PROGRAM REVIEW
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	A summary report on differences between work performed and work described in the SCP. The information is preferred to be provided in a table. It is recommended that all changes in work described in the SCP be documented and tracked as changes throughout the studies and work.
Information will be used to support:	
The Information is needed by/for (date or event):	Six months prior to filing the LA
Most likely source of the Information:	No information is available since only limited site characterization is available
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS License Application Annotated Outline

**Section 1.7 Statement of Compliance with the Performance
Objectives of 10 CFR 60 and Summary of Performance
Assessment Results**

TABLE OF CONTENTS

	Page
1.7 STATEMENT OF COMPLIANCE WITH THE PERFORMANCE OBJECTIVES OF 10 CFR 60 AND SUMMARY OF PERFORMANCE ASSESSMENT RESULTS	1.7-1
REFERENCES	1.7-3

LIST OF TABLES

LIST OF FIGURES

LIST OF INFORMATION NEEDS

1.7-1 Text generated based upon the results of that contained in Chapters 3, 4, 5, and 6.

Date: 03/31/95

1.7 STATEMENT OF COMPLIANCE WITH THE PERFORMANCE OBJECTIVES OF 10 CFR 60 AND SUMMARY OF PERFORMANCE ASSESSMENT RESULTS

[The following discussions describe whether the repository systems meet the performance objectives of 10 CFR 60.111, 60.112, and 60.113. A summary of the Performance Assessment discussed in Chapter 6 will also be provided. [INN 1.7-1]]

[Proposed Outline:

- Descriptions of the way in which the repository systems meet the performance objectives of 10 CFR 60.112, 60.113, and 60.114.
- Overall System Performance
 - Selection of geologic setting assures that releases of radioactive materials to accessible environment following permanent closure meet applicable environmental standards.
 - Design assures that releases of radioactive materials to accessible environment following permanent closure meet applicable environmental standards.
- Engineered Barrier Systems (EBSs) Performance
 - Containment of high-level waste within the waste packages will be substantially complete for a period to be determined by NRC, but not less than 300 years nor more than 1,000 years after permanent closure of the repository.
 - The release rate of any radionuclide from the EBS following the containment period will not exceed one part in 100,000 per year of the inventory of that radionuclide calculated to be present 1,000 years following permanent closure, or such other fraction of the inventory as may be specified or approved by NRC.
 - This requirement does not apply to any radionuclide which is released at a rate less than 0.1% of the calculated total release rate limit.

- Geologic Setting
 - The geologic repository is located so that pre-waste emplacement ground water travel time along the fastest path of likely radionuclide travel from the disturbed zone to the accessible environment shall at least 1,000 years or such other travel time as may be specified or approved by NRC.
- Summary of results of the Performance Assessment described in Chapter 6.]

REFERENCES

10 CFR 60, Disposal of High-Level Radioactive Wastes in Geologic Repositories

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 1.7-1
Section Number and Title:	1.7 STATEMENT OF COMPLIANCE WITH THE PERFORMANCE OBJECTIVES OF 10 CFR 60 AND SUMMARY OF PERFORMANCE ASSESSMENT RESULTS
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	N/A
Explicit description of the needed information:	Text generated based upon the results of that contained in Chapters 3, 4, 5, and 6. This text should be written to demonstrate the overall theme/approach used throughout the LA. See attachment for example.
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	
Information Source Description:	None Identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

Attachment to INN 1.7-1

Example

[The MGDS safety arguments are based upon system components which are shown to be robust using a conservative Performance Assessment approach. The waste package is shown to exceed the required life of 300 to 1000 years by a factor of 33 to 10. The engineered barrier surrounding the waste package is shown to retard radionuclide transport for ? years should a package fail. The repository has been designed to prevent liquid from contacting the waste package. The natural barrier system has been shown to significantly retard radionuclide migration to the accessible environment under scenarios that could cause premature waste package failure. The multi-barrier system has been shown using conservative analyses to provide complete containment, and each component (e.g., the EBS and the natural barrier system) have been shown to independently meet the requirement of waste containment for 10,000 years. The defense in depth approach is demonstrated throughout this LA.]

MGDS License Application Annotated Outline

Chapter 2.0 General Information for the Safety Analysis Report

TABLE OF CONTENTS

	Page
2.0 GENERAL INFORMATION FOR THE SAFETY ANALYSIS REPORT	2.0-1
2.0.1 Overview And Summary Of MGDS Project	2.0-1
2.0.2 Safety Analysis Report Organization	2.0-1
2.0.3 Supporting Information	2.0-1
REFERENCES	2.0-2
ACRONYMS AND ABBREVIATIONS	2.0-3

LIST OF TABLES

LIST OF FIGURES

LIST OF INFORMATION NEEDS

Date: 03/31/95

2.0 GENERAL INFORMATION FOR THE SAFETY ANALYSIS REPORT

[Skeleton Text Has Not Been Developed For This Section]

[The Mined Geologic Disposal System (MGDS) is a U.S. Department of Energy (DOE) project aimed at providing a workable geologic repository for radioactive High-Level Waste produced by the U.S. domestic commercial nuclear industry and the U.S. defense industries.]

2.0.1 Overview And Summary Of MGDS Project

[Brief history of Project. This gives the reader an appreciation of what follows and sets the tone for the remainder of the safety analysis sections.]

2.0.2 Safety Analysis Report Organization

[Breakdown of chapters with a summary of each chapter's content.]

2.0.3 Supporting Information

[Description of types of supporting information to be used in the safety analysis sections]

List of various sources

Reference Section 2.3 for use of the Nuclear Regulatory Commission (NRC) technical positions, and Section 2.4 for requirements for further technical information.

The *Format and Content Reg Guide*, DG-3003, requests the project description be done in terms of the systems organizational approach of the draft regulatory guide. Use the Catawba Final Safety Analysis Report as a guide for this introductory section.]

REFERENCES

ACRONYMS AND ABBREVIATIONS

DOE	U.S. Department of Energy
M&O	Management and Operating Contractor
MGDS	Mined Geologic Disposal System
NRC	Nuclear Regulatory Commission
TIDP	Technical Information Development Program

MGDS License Application Annotated Outline

Section 2.1 Identification of Agents and Contractors

TABLE OF CONTENTS

	Page
2.1 IDENTIFICATION OF AGENTS AND CONTRACTORS	2.1-1
2.1.1 Design Agents and Contractors	2.1-1
2.1.2 Construction Agents and Contractors	2.1-1
2.1.3 Operations Agents and Contractors	2.1-1
2.1.4 Consultants and Outside Service Organizations	2.1-1
REFERENCES	2.1-2

LIST OF TABLES

2.1.1-1	Agents and Contractors Responsible for MGDS Design [INN 2.1.1-1]
2.1.2-1	Agents and Contractors Responsible for MGDS Construction [INN 2.1.2-1]
2.1.3-1	Agents and Contractors Responsible for MGDS Operations [INN 2.1.3-1]
2.1.4-1	Consultants and Outside Service Organizations [INN 2.1.4-1]

SKELETON TEXT

Date: 03/31/95

YMP/94-05, Rev. 0

LIST OF FIGURES

- | | |
|---------|---|
| 2.1.1-1 | Design Organization [INN 2.1.1-2] |
| 2.1.2-1 | Construction Organization [INN 2.1.2-2] |
| 2.1.3-1 | Operations Organization [INN 2.1.3-2] |

LIST OF INFORMATION NEEDS

- 2.1-1 Identification of the principal consultants and outside service organizations, including quality assurance auditors, used during design, construction, and operation of the MGDS.
- 2.1.1-1 Company names, addresses, and technical scope of work for all agents and contractors involved in MGDS design.
- 2.1.1-2 Organization chart for all agents and contractors involved in MGDS design.
- 2.1.2-1 Company names, addresses, and technical scope of work for all agents and contractors involved in MGDS construction.
- 2.1.2-2 Organization chart for all agents and contractors involved in MGDS construction.
- 2.1.3-1 Company names, addresses, and technical scope of work for all agents and contractors involved in MGDS operations.
- 2.1.3-2 Organization chart for all agents and contractors involved in MGDS operations.
- 2.1.4-1 Company names, addresses, and technical scope of work for all consultants and outside service organizations involved in MGDS design, construction, and operations.

2.1 IDENTIFICATION OF AGENTS AND CONTRACTORS

[The prime agents and contractors for the design, construction, and operation of the MGDS will be identified in this section. Also to be identified will be the principal consultants and outside service organizations, including quality assurance auditors. The division of work between agents, contractors, consultants, and outside service organizations will be clearly delineated.] [INN 2.1-1]

2.1.1 Design Agents and Contractors

[The design agents and contractors responsible for the MGDS design will be identified in Table 2.1.1-1 [INN 2.1.1-1]. The MGDS design organization is illustrated in Figure 2.1.1-1 [INN 2.1.1-2].]

2.1.2 Construction Agents and Contractors

[The construction agents and contractors responsible for the MGDS design are identified in Table 2.1.2-1 [INN 2.1.2-1]. The MGDS construction organization is illustrated in Figure 2.1.2-1 [INN 2.1.2-2].]

2.1.3 Operations Agents and Contractors

[The agents and contractors responsible for the MGDS operations are identified in Table 2.1.3-1 [INN 2.1.3-1]. The MGDS operations organization is illustrated in Figure 2.1.3-1 [INN 2.1.3-2].]

2.1.4 Consultants and Outside Service Organizations

[The consultants and outside service organizations are identified in Table 2.1.4-1 [INN 2.1.4-1].]

REFERENCES

Date: 03/31/95

Table 2.1.1-1 Agents and Contractors Responsible for MGDS Design

Agent/Contractor	Address	Technical Work Area

[This table shows the prime agents and contractors during design. It will delineate the division of technical work areas between each.] [INN 2.1.1-1]

Table 2.1.2-1 Agents and Contractors Responsible for MGDS Construction

Agent/Contractor	Address	Technical Work Area

[This table shows the prime agents and contractors during construction. It will delineate the division of technical work areas between each.] [INN 2.1.2-1]

Table 2.1.3-1 Agents and Contractors Responsible for MGDS Operations

Agent/Contractor	Address	Technical Work Area

[This table shows the prime agents and contractors during construction. It will delineate the division of technical work areas between each.] [INN 2.1.3-1]

Table 2.1.4-1 Consultants and Outside Service Organizations

Agent/Contractor	Address	Technical Work Area	Phase

[This table will show the outside service organizations during design, construction, and operation phases. It will delineate the division of technical work areas between each.]
[INN 2.1.4-1]

FIGURE CAPTIONS

Figure 2.1.1-1. Design Organization [INN 2.1.1-2]

Organization chart for design, including principal area of responsibility.

Figure 2.1.2-1. Construction Organization [INN 2.1.2-2]

Organization chart for construction, including principal area of responsibility.

Figure 2.1.3-1. Operations Organization [INN 2.1.3-2]

Organization chart for operation, including principal area of responsibility .

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 2.1-1
Section Number and Title:	2.1 IDENTIFICATION OF AGENTS AND CONTRACTORS
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	
Explicit description of the needed information:	Identification of the principal consultants and outside service organizations, including quality assurance auditors, used during design, construction, and operation of the MGDS. It should be noted that the list identified in the preceding sentence is not necessarily complete and should be developed as is necessary to answer the request for information in the FCRG and the LARP.
Information will be used to support:	
The Information is needed by/for (date or event):	
Most likely source of the Information:	
Information Source Description:	
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 2.1.1-1
Section Number and Title:	2.1 IDENTIFICATION OF AGENTS AND CONTRACTORS
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Table 2.1.1-1
Explicit description of the needed information:	Company names, addresses, and technical scope of work for all agents and contractors involved in MGDS design.
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Management and Operating Contractor (M&O)
Information Source Description:	None
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 2.1.1-2
Section Number and Title:	2.1 IDENTIFICATION OF AGENTS AND CONTRACTORS
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 2.1.1-1
Explicit description of the needed information:	Organization chart for all agents and contractors involved in MGDS design.
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	M&O
Information Source Description:	None
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 2.1.2-1
Section Number and Title:	2.1 IDENTIFICATION OF AGENTS AND CONTRACTORS
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Table 2.1.2-1
Explicit description of the needed information:	Company names, addresses, and technical scope of work for all agents and contractors involved in MGDS construction.
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	M&O
Information Source Description:	None
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 2.1.2-2
Section Number and Title:	2.1 IDENTIFICATION OF AGENTS AND CONTRACTORS
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 2.1.2-1
Explicit description of the needed information:	Organization chart for all agents and contractors involved in MGDS construction.
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	M&0
Information Source Description:	None
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 2.1.3-1
Section Number and Title:	2.1 IDENTIFICATION OF AGENTS AND CONTRACTORS
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Table 2.1.3-1
Explicit description of the needed information:	Company names, addresses, and technical scope of work for all agents and contractors involved in MGDS operations.
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	M&O
Information Source Description:	None
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need

Information Need Number:	INN 2.1.3-2
Section Number and Title:	2.1 IDENTIFICATION OF AGENTS AND CONTRACTORS
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Figure 2.1.3-1
Explicit description of the needed information:	Organization chart for all agents and contractors involved in MGDS operations.
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	M&O
Information Source Description:	None
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 2.1.4-1
Section Number and Title:	2.1 IDENTIFICATION OF AGENTS AND CONTRACTORS
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Table 2.1.4-1
Explicit description of the needed information:	Company names, addresses, and technical scope of work for all consultants and outside service organizations involved in MGDS design, construction, and operations.
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	M&O
Information Source Description:	None
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS License Application Annotated Outline

Section 2.2 Material Incorporated by Reference

TABLE OF CONTENTS

2.2 MATERIAL INCORPORATED BY REFERENCE	2.2-1
REFERENCES	2.2-2

LIST OF TABLES

Table 2.2-1 Referenced Topical and Issue-Resolution Reports [INN 2.2-1]

LIST OF FIGURES

LIST OF INFORMATION NEEDS

- 2.2-1 Data for all materials incorporated by reference, including referenced topical and issue-resolution reports

2.2 MATERIAL INCORPORATED BY REFERENCE

Skeleton Text Has Not Been Developed For This Section

[Proposed Outline:

Identify scope of reports.

Define terms: topical or issue-resolution reports proprietary reports

Explain referencing system

Explain summarization requirements (summary required for test and analysis reports, and reports submitted in connection with other applications).

Refer to Table 2.2-1 [INN 2.2-1].

REFERENCES

TABLE TITLES

Table 2.2-1 Referenced Topical and Issue-Resolution Reports [INN 2.2-1]

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 2.2-1
Section Number and Title:	2.2 MATERIAL INCORPORATED BY REFERENCE
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Table 2.2-1
Explicit description of the needed information:	Data for all materials incorporated by reference, including referenced topical and issue-resolution reports.
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	All section lead authors must identify referenced material
Information Source Description:	Licensing Support System should contain information. (Integrate Licensing Support System format and Table 2.2-1 format.)
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS License Application Annotated Outline

Section 2.3 Use of Nuclear Regulatory Commission Technical Positions

TABLE OF CONTENTS

	Page
2.3 USE OF NUCLEAR REGULATORY COMMISSION TECHNICAL POSITIONS	2.3-1
2.3.1 Definition of Applicable NRC Technical Positions	2.3-1
2.3.2 Justification of Exceptions	2.3-1
2.3.3 DOE Conformance to NRC Technical Positions	2.3-1
2.3.4 NRC Regulatory Guide Compliance Program	2.3-1
REFERENCES	2.3-2

LIST OF TABLES

Table 2.3.3-1 DOE Conformance to NRC Technical Positions [INN 2.3.3-1]

LIST OF FIGURES

LIST OF INFORMATION NEEDS

- 2.3.3-1 List of all NRC technical positions with following: Technical position number, title, revision; expected applicable Safety Analysis Section number, and any proposed exception.

2.3 USE OF NUCLEAR REGULATORY COMMISSION TECHNICAL POSITIONS

Skeleton Text Has Not Been Developed For This Section

[This section describes and justifies the extent to which DOE uses NRC technical positions.]

2.3.1 Definition of Applicable NRC Technical Positions

[Introduction and Definition of what constitutes an applicable NRC technical position (or conversely, what does not)]

2.3.2 Justification of Exceptions

[Explanation of how exceptions are justified. Use of table versus text in the safety analysis sections]

2.3.3 DOE Conformance to NRC Technical Positions

[Description of Table 2.3.3-1 [INN 2.3.3-1]]

2.3.4 NRC Regulatory Guide Compliance Program

Description of program for ensuring compliance with applicable NRC regulatory guides including those issued or revised during and after license process.

REFERENCES

Table 2.3.3-1 DOE Conformance to NRC Technical Positions

Technical Position Number	Title	Revision	Applicable (yes/no)	Applicable SAR Section(s)	Exceptions	
					Identify	Justification Summarize

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 2.3.3-1
Section Number and Title:	2.3 USE OF NRC TECHNICAL POSITIONS
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Table 2.3.3-1
Explicit description of the needed information:	List of all NRC technical positions with following: Technical position number, title, revision; expected applicable Safety Analysis Section number, and any proposed exception.
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	Licensing Group
Information Source Description:	Licensing Support System
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS License Application Annotated Outline

Section 2.4 Requirements for Further Technical Information

TABLE OF CONTENTS

	Page
2.4 REQUIREMENTS FOR FURTHER TECHNICAL INFORMATION	2.4-1
2.4.1 Technical Information Not Supplied	2.4-1
2.4.2 Technical Information Development Programs (TIDPs)	2.4-1
REFERENCES	2.4-2

LIST OF TABLES

Table 2.4.1-1 Technical Information Not Supplied with the Safety Analysis Sections
[INN 2.4.1-1]

Table 2.4.2-1 Technical Information Development Programs [INN 2.4.1-1]

LIST OF FIGURES

LIST OF INFORMATION NEEDS

2.4.1-1 Identify information for Tables 2.4.1-1 and 2.4.2-1

Date: 03/31/95

2.4 REQUIREMENTS FOR FURTHER TECHNICAL INFORMATION

Skeleton Text Has Not Been Developed For This Section

2.4.1 Technical Information Not Supplied

[See Table 2.4.1-1 [INN 2.4.1-1]]

2.4.2 Technical Information Development Programs (TIDPs)

[see Table 2.4.2-1 [INN 2.4.1-1] which identifies the safety analysis section reference for TIDP discussion. This discussion includes:

Affected safety feature or components

Program description. Provide sufficient detail to show how the information was obtained

Describe specific technical information which must be obtained to demonstrate acceptable resolution of the TIDP

Discuss (a) design alternatives or (b) operational restrictions if results of the TIDP do not demonstrate acceptable resolution of the TIDP

If a reference is made to material incorporated by reference (see Section 2.2), discuss applicability of each technical information development item to the repository.

REFERENCES

Date: 03/31/95

Table 2.4.1-1 Technical Information Not Supplied with the Safety Analysis Sections

Item	Technical Information	Explanation
	Identify	Explain why such information is not reasonably available

[INN 2.4.1-1]

Table 2.4.2-1 Technical Information Development Programs

Item	Program Title	Type (Note 1)	Information To Be Obtained (Note 2)	SAR Reference For Program Discussion	Schedule for Completion (Note 3)

Note 1: Program

<u>Type</u>	<u>Description</u>
-------------	--------------------

- | | |
|---|--|
| A | Required to determine adequacy of new design |
| B | Used to demonstrate margin of conservatism of a proven design |
| C | Conducted during operations to demonstrate the acceptability of contemplated future changes in design or operation |
| D | Other |

Note 2: This is information to be obtained to demonstrate acceptable resolution of the TIDP.

Note 3: Scheduled date for repository operation startup is TBD; however, the TIDP completion date will be prior to repository startups.

[INN 2.4.1-1]

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 2.4.1-1
Section Number and Title:	2.4 REQUIREMENTS FOR FURTHER TECHNICAL INFORMATION
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Tables 2.4.1-1 and 2.4.2-1
Explicit description of the needed information:	1. Identify technical information that has not been supplied. 2. Identify TIDPs.
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	All lead authors
Information Source Description:	None identified
Does the supporting data need to be QA?	N/A

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS License Application Annotated Outline

Section 2.5 Radioactive Materials

TABLE OF CONTENTS

	Page
2.5 RADIOACTIVE MATERIALS	2.5-1
REFERENCES	2.5-2

LIST OF TABLES

Table 2.5-1 Radioactive Material to be Received and Possessed at the GROA [INN 2.5-1]

Table 2.5-2 Radioactive Material Specifications - Type 1 [INN 2.5-1]

Table 2.5-X Radioactive Material Specifications - Type "N" [INN 2.5-1]

LIST OF FIGURES

LIST OF INFORMATION NEEDS

2.5-1 Provide an identification of the types of fuels.

Date: 03/31/95

2.5 RADIOACTIVE MATERIALS

Skeleton Text Has Not Been Developed For This Section

[This section provides a description of the kind, amount, and specifications of the radioactive material proposed to be received and possessed at the geologic repository operations area.]

[INN 2.5-1]

REFERENCES

[Oak Ridge has done considerable work on this subject. They keep a database and have done some publishing.]

DOE/RW-0184, Characteristics of Potential Repository Wastes

DOE/RW-0351P, Waste Acceptance System Requirements Document

Date: 03/31/95

Table 2.5-1 Radioactive Material to be Received and Possessed at the GROA

Type	Amount Specification	Other Non-Specification Information
1	Table 2.5-2	
2	Table 2.5-3	
3	Table 2.5-4	
-	-	
-	-	
-	-	
-	-	

[INN 2.5-1]

TABLE TITLES

Table 2.5-2 Radioactive Material Specifications - Type 1

Itemize specification values. Typical items for spent fuel could be:

- Burnup, max
- Original enrichment, max
- Individual nuclide concentration, max
- Heat generation, max
- Fuel defects, max.

[INN 2.5-1]

Table 2.5-X Radioactive Material Specifications - Type "N"

[Similar to Table 2.5-2 for each type of material]

[INN 2.5-1]

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 2.5-1
Section Number and Title:	2.5 RADIOACTIVE MATERIALS
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Tables 2.5-1, 2.5-2, 2.5-X
Explicit description of the needed information:	<p>Provide an identification of the types of fuels. In addition, provide the following information for SNF and HLW as applicable:</p> <ul style="list-style-type: none"> • Burnup (max), • Original enrichment (max), • Individual nuclide concentration, • Heat generation, • Field defects, etc.
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	
Information Source Description:	None identified
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS License Application Annotated Outline

Section 2.6 License Specifications

TABLE OF CONTENTS

	Page
2.6 LICENSE SPECIFICATIONS	2.6-1
2.6.1 Scope	2.6-1
2.6.2 Probable Subject of License Specification	2.6-1
2.6.3 Variable and Condition	2.6-1
2.6.4 Justification System	2.6-1
REFERENCES	2.6-2

LIST OF TABLES

Table 2.6.2-1 License Specification Variables [INN 2.6-1]

Table 2.6.3-1 License Specification Conditions [INN 2.6-1]

Table 2.6.3-2 License Specification Parameters [INN 2.6-1]

LIST OF FIGURES

LIST OF INFORMATION NEEDS

- 2.6-1 Proposed variables, conditions, or other items that are probable subjects of license specifications.

2.6 LICENSE SPECIFICATIONS**Skeleton Text Has Not Been Developed For This Section**

[The purpose of this section is to identify and justify those variables, conditions, or other items the DOE determines to be probable subjects of license specifications. A statement similar to the following should be made in a potential license application: The variables, conditions, and other items identified and justified above can result in an operating envelope which protects the health and safety of the public and DOE workers.][INN 2.6-1]

2.6.1 Scope**2.6.2 Probable Subject of License Specification****2.6.3 Variable and Condition**

Variable - parameter such as temperature, water level, radioactivity level, which is subject to variation

Condition - State of operation of facility or system.

2.6.4 Justification System

An operational analysis is performed in order to justify variables and conditions, which will result in determination of operating parameter boundaries. In the case of a repository operations facility, as opposed to an operating nuclear station, protection systems are utilized for containing and maintaining the spent fuel, versus containing high pressure, high temperature radioactive fluids and producing electricity.

As part of this analysis, a series of block diagrams categorizing events and system responses is created to allow determination of hardware and functional requirements of each system. Once the required actions of the systems have been identified, requirements and restrictions are established for system hardware to ensure that the required actions can be achieved within the redundancy goals set for the system or action.

Required action to be taken, should a protection requirement not be met, is determined by considering the associated unacceptable results.

The requirements obtained by the above described method are then simplified into license specifications, which encompass the operational requirements, but are specific enough to be readily used by facility operations and management.

REFERENCES

Date: 03/31/95

Table 2.6.2-1 License Specification Variables

Variables which are probable subjects of license specifications

<u>Value</u>			<u>Justification</u>	
<u>Item</u>	<u>Description</u> <u>Summary</u>	<u>Nominal</u> <u>Ref SAR Section</u>	<u>Lower</u> <u>Limit</u>	<u>Upper</u> <u>Limit</u>

[INN 2.6-1]

Table 2.6.3-1 License Specification Conditions

Conditions which are probable subjects of license specifications.

<u>Value</u>			<u>Justification</u>	
<u>Item</u>	<u>Description</u> <u>Summary</u>	<u>Nominal</u> <u>Ref SAR Section</u>	<u>Lower</u> <u>Limit</u>	<u>Upper</u> <u>Limit</u>

[INN 2.6-1]

Table 2.6.3-2 License Specification Parameters

Variables which are probable subjects of license specifications

<u>Value</u>			<u>Justification</u>	
<u>Item</u>	<u>Description</u> <u>Summary</u>	<u>Nominal</u> <u>Ref SAR Section</u>	<u>Lower</u> <u>Limit</u>	<u>Upper</u> <u>Limit</u>

[INN 2.6-1]

Date: 03/31/95

MGDS LA Annotated Outline Form A: Information Need	
Information Need Number:	INN 2.6-1
Section Number and Title:	2.6 LICENSE SPECIFICATIONS
Lead Author/Support Author and Phone:	T.M. Williamson (702) 794-1821
Primary LA AO Table or Figure INN supports (if applicable):	Tables 2.6.2-1, 2.6.3-1, 2.6.3-2
Explicit description of the needed information:	Proposed variables, conditions, or other items that are probable subjects of license specifications.
Information will be used to support:	
The Information is needed by/for (date or event):	TBD
Most likely source of the Information:	All section lead authors
Information Source Description:	None
Does the supporting data need to be QA?	

INTEGRATOR (PMO):	
Date information will be available:	
Deliverable providing information:	
If the data needed is QA, then the QA source document number is:	

MGDS Annotated Outline

Chapter 3.0 Natural Systems Of the Geologic Setting

TABLE OF CONTENTS

	Page
3.0 NATURAL SYSTEMS OF THE GEOLOGIC SETTING	3.0-1
REFERENCES	3.0-2
ACRONYMS AND ABBREVIATIONS	3.0-3

LIST OF TABLES

LIST OF FIGURES

LIST OF INFORMATION NEEDS

3.0 NATURAL SYSTEMS OF THE GEOLOGIC SETTING

Skeleton Text Has Not Been Developed For This Section

REFERENCES

Date: 03/31/95

ACRONYMS AND ABBREVIATIONS

AJO	Adjustment for Joint Orientation
ALDS	Automated Lightning Detection System
ASTM	American Society for Testing and Materials
BSE	Basalt of the Silicic Episode
CFu	Crater Flat Undifferentiated Unit
CFVZ	Crater Flat Volcanic Zone
CHn/CHn1	Calico Hills non-welded unit
CHnv	Calico Hills non-welded vitric
CHnz	Calico Hills non-welded zeolitized
CNSB	Central Nevada Seismic Belt
CPDB	Conceptual Perimeter Drift Boundary
DOE	U.S. Department of Energy
ESF	Exploratory Studies Facility
EMP	Environmental Monitoring Program
GFZ	Garlock Fault Zone
GROA	Geologic Repository Operations Area
INN	Information Need Number
NAS/NRC	National Academy of Sciences/National Research Council
NTS	Nevada Test Site
NWS	National Weather Service
OPB	Older Post-Caldera Basalt
PTn	Paintbrush Nonwelded Unit
QA	Quality Assurance
QAL	Quaternary Alluvium
REE	Rare-Earth Element
RMR	Rock Mass Rating
RQD	Rock Quality Designation
S _v	Vertical Stress Axis
S _H	Maximum Horizontal Stress Axis
S _h	Minimum Horizontal Stress Axis

Date: 03/31/95

ACRONYMS AND ABBREVIATIONS (continued)

SAIC	Science Applications International Corp.
SNGBZ	Sierra Nevada-Great Basin Boundary Zone
SNTZ	Southern Nevada Transverse Zone
SNVF	Southwestern Nevada Volcanic Field
SRF	Stress Reduction Factor
TCw	Tiva Canyon Welded Unit
TL	Thermoluminescence
TMS	Thermomechanical Stratigraphy
TSw	Topopah Spring Welded Unit
TSw1	Topopah Spring welded unit, lithophysae-rich
TSw2	Topopah Spring welded unit, lithophysae-poor
TSw3	Topopah Spring welded unit, vitrophyre
UNR	University of Nevada at Reno
UNE	Underground Nuclear Explosion
USBM	United States Bureau of Mines
USGS	United States Geological Survey
YMP	Yucca Mountain Site Characterization Project
YMR	Yucca Mountain Region
YPB	Younger Post-Caldera Basalt

MGDS License Application Annotated Outline

Section 3.1 Description of Individual Systems and Characteristics of the Site

Date: 03/31/95

TABLE OF CONTENTS

	Page
3.1 DESCRIPTION OF INDIVIDUAL SYSTEMS AND CHARACTERISTICS OF THE SITE	3.1-1
3.1.0 Introduction	3.1-1
3.1.1 Geologic System	3.1-1
3.1.1.1 Regional Geology	3.1-2
3.1.1.1.1 Geomorphology and Topographic Features in the Region of the Site	3.1-2
3.1.1.1.2 Stratigraphy and Lithology of the Region	3.1-2
3.1.1.1.2.1 Older Precambrian Crystalline Rocks	3.1-3
3.1.1.1.2.2 Precambrian and Lower Cambrian Sedimentary Rocks	3.1-3
3.1.1.1.2.3 Middle Cambrian through Devonian Sedimentary Rocks	3.1-4
3.1.1.1.2.4 Mississippian through Permian Sedimentary Rocks	3.1-4
3.1.1.1.2.5 Mesozoic Rocks	3.1-4
3.1.1.1.2.6 Tertiary Sedimentary Rocks	3.1-5
3.1.1.1.2.7 Tertiary and Quaternary Igneous Rocks	3.1-5
3.1.1.1.2.8 Tertiary and Quaternary Surficial Deposits	3.1-5
3.1.1.1.3 Structural Geology and Tectonic Information	3.1-5
3.1.1.1.3.1 Regional Structural Features and Current State of Stress	3.1-6
3.1.1.1.3.1.1 Plate Tectonic Setting	3.1-6
3.1.1.1.3.1.2 Regionally Significant Faults	3.1-7
3.1.1.1.3.1.3 Structural Features and Seismicity	3.1-11
3.1.1.1.3.2 Regional Volcanic Features	3.1-12
3.1.1.1.3.2.1 Silicic Volcanism	3.1-12
3.1.1.1.3.2.2 Basaltic Volcanism	3.1-13
3.1.1.1.3.3 Alternative Tectonic Models	3.1-17
3.1.1.1.4 Seismology	3.1-18
3.1.1.1.4.1 Regional Seismotectonic Setting	3.1-19
3.1.1.1.4.2 Regional Seismicity	3.1-21
3.1.1.1.4.2.1 Distribution of Seismicity	3.1-24
3.1.1.1.4.2.2 Significant Historical Earthquakes	3.1-29
3.1.1.1.4.2.3 State of Regional Tectonic Stress Field	3.1-38
3.1.1.1.4.3 Relation of Seismicity to Geologic/Tectonic Structures and Settings	3.1-39
3.1.1.1.5 Natural Resources	3.1-39
3.1.1.1.5.1 Methods of Mineral-Energy-Resource Assessment	3.1-41

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
3.1.1.1.5.2 Mineral Commodities Data	3.1-42
3.1.1.1.5.2.1 Precious- and Base-Metal Deposits	3.1-43
3.1.1.1.5.2.2 Industrial Minerals and Rocks	3.1-49
3.1.1.1.5.3 Geothermal Resources	3.1-53
3.1.1.1.5.4 Hydrocarbon Resources	3.1-56
3.1.1.1.5.5 Conceptual Models of Resource Formation	3.1-59
3.1.1.1.6 Geophysics	3.1-64
3.1.1.2 Site Geology	3.1-64
3.1.1.2.1 Geomorphology and Topographic Features of the Site Area	3.1-64
3.1.1.2.1.1 Erosion at the Site	3.1-64
3.1.1.2.2 Stratigraphy and Lithology of the Site	3.1-65
3.1.1.2.2.1 Introduction	3.1-65
3.1.1.2.2.2 Pre-Cenozoic Rocks	3.1-66
3.1.1.2.2.3 Mid-Tertiary Pyroclastic Rocks	3.1-67
3.1.1.2.2.4 Younger Basalt	3.1-75
3.1.1.2.2.5 Surficial Deposits	3.1-75
3.1.1.2.3 Site Structural Geology and Tectonics	3.1-78
3.1.1.2.3.1 Faulting at Yucca Mountain	3.1-78
3.1.1.2.3.2 Quaternary Faulting History	3.1-78
3.1.1.2.3.2.1 Quaternary Faults Within 20 km of the Site ...	3.1-79
3.1.1.2.3.2.2 Significant Quaternary Faults between 20 and 100 km of the Site	3.1-83
3.1.1.2.3.3 Folding at Yucca Mountain	3.1-89
3.1.1.2.3.4 Fractures at Yucca Mountain	3.1-90
3.1.1.2.3.5 Volcanism at Yucca Mountain	3.1-90
3.1.1.2.3.5.1 Silicic Volcanism	3.1-90
3.1.1.2.3.5.2 Basaltic Volcanism	3.1-92
3.1.1.2.3.5.2.1 Basalt of the Silicic Episode	3.1-93
3.1.1.2.3.5.2.2 Postcaldera Basalt of the YMR	3.1-95
3.1.1.2.3.5.2.3 The Lathrop Wells Center	3.1-106
3.1.1.2.3.5.2.4 Tectonic Setting in Relation to Basaltic Volcanism	3.1-106
3.1.1.2.3.5.2.5 Petrologic and Geochemical Constraints on Basaltic Volcanism	3.1-106
3.1.1.2.3.5.2.6 Summary of Basaltic Volcanism	3.1-107
3.1.1.2.4 Seismology	3.1-107
3.1.1.2.4.1 Local Site Seismicity	3.1-107
3.1.1.2.4.1.1 Northern NTS	3.1-108
3.1.1.2.4.1.2 Southern NTS	3.1-109
3.1.1.2.4.1.3 Northern Amargosa Valley - Sarcobatus Flat .	3.1-109
3.1.1.2.4.1.4 Northern Death Valley Region	3.1-110

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
3.1.1.2.4.1.5	1992 M_L 5.6 Little Skull Mountain
	Earthquake 3.1-110
3.1.1.2.4.2	Ground Motion Model 3.1-111
3.1.1.2.4.2.1	Introduction 3.1-111
3.1.1.2.4.2.2	Characteristics of Ground Motions at Yucca
	Mountain 3.1-115
3.1.1.2.4.3	Seismic Hazard Assessment 3.1-119
3.1.1.2.4.3.1	Summary of Site Response Model Required
	for Seismic Hazard Assessment 3.1-119
3.1.1.2.4.3.2	Data Analysis Methodology for Development
	of Site Response Model 3.1-119
3.1.1.2.4.3.3	Estimation of Uncertainties 3.1-120
3.1.1.2.4.3.4	Characteristics of Site Response at Yucca
	Mountain 3.1-120
3.1.1.2.4.4	Identification of Seismic Sources 3.1-123
3.1.1.2.5	Natural Resources 3.1-124
3.1.1.2.6	Geophysics 3.1-124
3.1.1.2.7	Geoengineering 3.1-124
3.1.1.2.7.1	Three-Dimensional Geoengineering Model . . . 3.1-125
3.1.1.2.7.1.1	Stratigraphic Framework for Testing/
	Analysis 3.1-125
3.1.1.2.7.1.2	Geographic Distribution of Holes 3.1-126
3.1.1.2.7.2	Spatial Variability and Sampling Approach . . . 3.1-126
3.1.1.2.7.3	Mechanical Properties of Intact Rock 3.1-126
3.1.1.2.7.3.1	Elastic Properties 3.1-127
3.1.1.2.7.3.2	Compressive Strength 3.1-129
3.1.1.2.7.3.3	Tensile Strength 3.1-134
3.1.1.2.7.3.4	Shear Strength of Intact Rock and Triaxial
	Test 3.1-134
3.1.1.2.7.3.5	Time-Dependent (Creep) Properties of
	Rock 3.1-136
3.1.1.2.7.4	Mechanical Properties of Discontinuities 3.1-136
3.1.1.2.7.4.1	Properties of Natural vs. Simulated
	Discontinuities 3.1-137
3.1.1.2.7.4.2	Effect of Infilling on Joint Properties 3.1-138
3.1.1.2.7.4.3	Properties of Healed and Unhealed Joints 3.1-138
3.1.1.2.7.4.4	Effect of Test Conditions on Joint Properties . . 3.1-138
3.1.1.2.7.4.5	Time-Dependent (Short-Term) Behavior of
	Joints 3.1-138
3.1.1.2.7.4.6	Time-Dependent (Creep) Properties of Joints . . 3.1-140
3.1.1.2.7.5	Nature and Extent of Joints at the Yucca
	Mountain Site 3.1-140

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
3.1.1.2.7.6	Mechanical Properties of Rock Mass 3.1-142
3.1.1.2.7.6.1	Rock Mass Rating (RMR) System and Q Rating 3.1-142
3.1.1.2.7.6.2	Rock Mass Time-Dependent Properties at Elevated Temperature 3.1-142
3.1.1.2.7.7	Thermal Properties of Intact Rock 3.1-142
3.1.1.2.7.7.1	Thermal Conductivity 3.1-142
3.1.1.2.7.7.2	Heat Capacity of Intact Rock 3.1-142
3.1.1.2.7.7.3	Thermal Expansion 3.1-142
3.1.1.2.7.8	Thermal Properties of Rock Mass 3.1-142
3.1.1.2.7.8.1	Rock Mass Thermal Properties Measured In Situ 3.1-142
3.1.1.2.7.8.2	Rock Mass Thermal Properties vs. Intact Rock Thermal Properties 3.1-142
3.1.1.2.7.8.3	Rock Mass Thermal Properties During Cooling Phase 3.1-142
3.1.1.2.7.9	Existing Stress Field 3.1-142
3.1.1.2.7.10	Special Engineering Properties 3.1-142
3.1.1.2.7.11	Engineering Properties of Surficial Material . . 3.1-142
3.1.1.2.7.12	Excavation Characteristics of Rock Mass 3.1-142
3.1.1.2.7.13	Estimated Water Inflow 3.1-142
3.1.1.2.7.14	Ground Support Requirements 3.1-142
3.1.1.2.7.15	Overview of Mechanical, Thermal, and Thermomechanical Models Using Geoengineering Properties 3.1-142
3.1.1.3	Future Variation in Geologic Process 3.1-142
3.1.2	Hydrologic System 3.1-143
3.1.2.1	Surface Water Hydrology 3.1-143
3.1.2.1.1	Description of Surface-Water Bodies and Physical Characteristics of Drainage Areas . . . 3.1-144
3.1.2.1.2	Surface-Water Monitoring Network 3.1-146
3.1.2.1.3	Water Control Structures and Diversions 3.1-149
3.1.2.1.4	Flood History 3.1-150
3.1.2.1.5	Flood Potential 3.1-151
3.1.2.1.6	Chemical Composition of Identified Bodies of Surface-Water 3.1-155
3.1.2.1.7	Location, Quantity, and Quality of Surface Water Extracted 3.1-156
3.1.2.1.8	Projected Surface-Water Uses 3.1-157
3.1.2.2	Regional Hydrogeology 3.1-157
3.1.2.2.1	Regional Flow System Boundaries and Hydrogeologic Units Overview 3.1-157

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
3.1.2.2.1.1	Hydrogeologic Units 3.1-158
3.1.2.2.1.2	Basis for Defining the Physical Boundaries of the Regional Hydrogeologic Systems 3.1-159
3.1.2.2.2	Potentiometric Levels and Hydraulic Gradients 3.1-162
3.1.2.2.3	Characteristics Of Hydrogeologic Units 3.1-164
3.1.2.2.4	Recharge and Discharge 3.1-169
3.1.2.2.5	Age of Regional Groundwater 3.1-169
3.1.2.2.6	Groundwater Flow Paths 3.1-169
3.1.2.2.7	Regional Paleohydrology 3.1-169
3.1.2.2.8	Regional Groundwater Use 3.1-178
3.1.2.2.9	Regional Groundwater Management Plans . . . 3.1-184
3.1.2.3	Site Hydrogeology 3.1-188
3.1.2.3.1	Baseline Monitoring Network 3.1-188
3.1.2.3.2	Site Flow System Boundaries and Hydro- geologic Units 3.1-190
3.1.2.3.2.1	Unsaturated Zone Hydrogeologic Units 3.1-190
3.1.2.3.2.2	Saturated Zone Hydrogeologic Units 3.1-192
3.1.2.3.3	Potentiometric Levels, Matric Potentials, and Gradients 3.1-192
3.1.2.3.3.1	Unsaturated Zone Potentials 3.1-192
3.1.2.3.3.2	Saturated Zone Potentials 3.1-194
3.1.2.3.4	Characteristics of Hydrogeologic Units 3.1-196
3.1.2.3.4.1	Unsaturated Zone Hydrologic Units 3.1-196
3.1.2.3.4.2	Saturated Zone Hydrogeologic Units 3.1-199
3.1.2.3.5	Site Groundwater Recharge 3.1-200
3.1.2.3.6	Site Groundwater Discharge 3.1-201
3.1.2.3.7	Age of Site Groundwater 3.1-201
3.1.2.3.8	Site Pathway Analysis 3.1-204
3.1.2.3.9	Local Groundwater Use 3.1-206
3.1.2.3.10	Site Paleohydrology 3.1-207
3.1.3	Geochemical System 3.1-214
3.1.3.1	Regional Geochemistry 3.1-215
3.1.3.2	Site Geochemistry 3.1-215
3.1.3.2.1	Geochemistry of the Site Rock 3.1-215
3.1.3.2.1.1	Geochemistry of the Topopah Spring Member 3.1-216
3.1.3.2.1.1.1	Major Element Composition 3.1-217
3.1.3.2.1.1.2	Primary Phases 3.1-219
3.1.3.2.1.1.3	High-Temperature Secondary Phases 3.1-221
3.1.3.2.1.1.4	Low Temperature Phases 3.1-224
3.1.3.2.1.2	Geochemistry of Calico Hills Formation 3.1-227

Date: 03/31/95

TABLE OF CONTENTS (continued)

	Page
3.1.3.2.2 Geochemistry of the Site Groundwater and Gas	3.1-227
3.1.3.2.3 Site Geochemistry Governing Radionuclide Mobility	3.1-227
3.1.4 Climatological and Meteorological Systems	3.1-227
3.1.4.1 Present Climate and Meteorology	3.1-227
3.1.4.1.1 Climate	3.1-228
3.1.4.1.1.1 Scales of Atmospheric Motion and General Climatic Perspective	3.1-228
3.1.4.1.1.1.1 Planetary Scale	3.1-229
3.1.4.1.1.1.2 Large-Scale Atmospheric Features	3.1-229
3.1.4.1.1.1.3 Mesoscale Atmospheric Features	3.1-233
3.1.4.1.1.1.4 Microscale Atmospheric Features	3.1-235
3.1.4.1.1.2 Climatological Parameters	3.1-235
3.1.4.1.1.2.1 Temperature	3.1-235
3.1.4.1.1.2.2 Precipitation	3.1-236
3.1.4.1.1.2.3 Atmospheric Moisture	3.1-238
3.1.4.1.1.2.4 Wind Speed and Direction	3.1-238
3.1.4.1.1.2.5 Upper Air Data	3.1-240
3.1.4.1.1.2.5.1 Winds	3.1-240
3.1.4.1.1.2.5.2 Mixing Heights	3.1-241
3.1.4.1.1.2.6 Atmospheric Pressure	3.1-241
3.1.4.1.1.2.7 Insolation (Sunshine)	3.1-243
3.1.4.1.1.2.8 Severe Weather and Obstructions to Visibility ..	3.1-243
3.1.4.1.1.2.9 Extremes	3.1-245
3.1.4.1.2 Site Meteorological Monitoring Network	3.1-246
3.1.4.1.3 Site Meteorology	3.1-249
3.1.4.2 Paleoclimatology	3.1-251
3.1.4.3 Future Climatic Variation	3.1-251
3.1.5 Integrated Natural System Response to the Maximum Design Thermal Loading	3.1-251
3.1.5.1 Response of Geomechanical Subsystem	3.1-251
3.1.5.2 Hydrologic Response to Thermal Loading	3.1-252
3.1.5.3 Response of Geochemical System to Thermal Loading	3.1-252
REFERENCES	3.1-253

LIST OF TABLES

3.1.1.1.4.2.1-1	List of Magnitude 5 and Greater Events Within 320 km of the Yucca Mountain Site [INN 3.1.1.1.4.2.1-1]
3.1.1.2.2.3-1	Stratigraphy, Age, and Magnetic Polarity of Tertiary Volcanic Rocks at Yucca Mountain
3.1.1.2.3.5.2-1	$^{40}\text{Ar}/^{39}\text{Ar}$ Ages of Basaltic Volcanic Centers in the Yucca Mountain Region
3.1.1.2.3.5.2.2-1	K-Ar and $^{40}\text{Ar}/^{39}\text{Ar}$ Ages of Quaternary Basalt of Crater Flat [INN 3.1.1.2.3.5.2.2-2]
3.1.1.2.4.2.2-1	List of Earthquakes Having Strong Motion Recordings Near Yucca Mountain
3.1.1.2.4.3.4-1	Reduction with Depth of Ground Motion Recorded on Rock
3.1.1.2.4.4-1	Fault Parameters for Significant Seismic Sources at the Yucca Mountain Site [INN 3.1.1.2.4.4-1]
3.1.1.2.7.1.1-1	Thermomechanical Stratigraphy
3.1.1.2.7.3.1-1	Unconfined Compressive Test Results
3.1.1.2.7.3.2-1	Unconfined Compressive Test on Saturated Samples of Various Sizes of Topopah Spring Tuff from Outcrops at Busted Butte
3.1.1.2.7.3.2-2	Compressive Test Results of Saturated and Oven Dry Samples
3.1.1.2.7.3.2-3	Effects of Changes in Strain Rate on Rock Properties for Yucca Mountain Tuffs
3.1.1.2.7.3.3-1	Tensile Strength of Yucca Mountain Tuff
3.1.1.2.7.3.4-1	Summary of Coulomb Failure Criteria Parameters
3.1.1.2.7.5-1	Fracture Orientations as Estimated from Oriented Core and Borehole Television Surveys
3.1.1.2.7.5-2	Thickness, Numbers of Fractures, and Linear Fracture, and Linear Fracture Frequencies in Tuff Units
3.1.1.2.7.5-3	Volumetric Fracture in a Unit Volume (m^3) of Rock

Date: 03/31/95

LIST OF TABLES (continued)

- | | |
|-------------------|---|
| 3.1.1.2.7.6.1-1 | Individual Rating Attributes for Parameters in the Rock Mass Rating System [INN 3.1.1.2.7.6.1-2] |
| 3.1.1.2.7.6.1-2 | Ratings of Rock Mass Classes and the Significance to Unsupported Tunnel Span and Average Stand-Up Time |
| 3.1.1.2.7.6.1-3 | Descriptors Applied to the Joint Alteration Number in the Rock Mass Rating System |
| 3.1.1.2.7.6.1-4 | Descriptors Applied to the Joint Water Reduction Factor in the Rock Mass Rating System |
| 3.1.1.2.7.6.1-5 | Descriptors Applied to the Stress Reduction Factor in the Rock Mass Rating System |
| 3.1.1.2.7.6.1.1-1 | Parameters Required by both the RMR and Q Classification Systems for the Determination of Rock Mass Quality Categories for the TSw2 Unit. |
| 3.1.1.2.7.6.1.1-2 | Values Utilized in the Analysis for the Appropriate Level of Probability and the Resulting Rock Mass Classification for the Q and RMR Systems |
| 3.1.1.2.7.6.1.1-3 | Q and RMR Values for Each of the Geologic Units Identified |
| 3.1.1.2.7.6.4.1-1 | Parameters for the Determination of Rock Mass Compressive Strength for each Rock Mass Category in each Geologic Unit |
| 3.1.1.2.7.6.4.3-1 | Elastic Modulus Values for each Rock Mass Quality Category and each Geologic Unit |
| 3.1.2.1.1-1 | Approximate Areas of the Eight Hydrographic Areas in the Hydrographic Study Area |
| 3.1.2.1.1-2 | Summary of Peak Streamflow Data for Selected Crest-Stage Sites in Hydrographic Study Area and Adjacent Areas |
| 3.1.2.1.1-3 | Springs, Seeps, and Phreatophyte Areas in the Hydrogeologic Study |
| 3.1.2.1.2-1 | Proposed and Existing Surface-Water Monitoring Sites |
| 3.1.2.1.4-1 | Flood Records at Selected Crest-Stage Sites |
| 3.1.2.1.5-1 | Christensen and Spahr Flash Flood Model |

Date: 03/31/95

LIST OF TABLES (continued)

3.1.2.1.6-1	Chemical Composition of Watercourses Adjacent to Yucca Mountain [INN 3.1.2.1.1-1]
3.1.2.1.6-2	Chemical Analysis of Water from Selected Springs
3.1.2.1.7-1	Quality of Texas Spring and Nevares Spring Water in Death Valley National Monument, California and Indian Springs Water, Beatty, Nevada
3.1.2.2.1.2-1	Summary of Estimates of Annual Groundwater Inflow, Recharge, and Outflow
3.1.2.2.2-1	Summary of Selected Wells Monitored for Water Levels at Yucca Mountain [INN 3.1.2.2.2-1]
3.1.2.2.3-1	Pumping Response Data for the Lower Carbonate Aquifer [INN 3.1.2.2.3-1]
3.1.2.2.3-2	Pumping Response Data for the Welded-Tuff Aquifer [INN 3.1.2.2.3-2 and INN 3.1.2.2.3-3]
3.1.2.2.3-3	Results of Analysis Using the Finite-Conductivity, Vertical-Fracture Model [INN 3.1.2.2.3-3]
3.1.2.2.8-1	Perennial Yield, Total Appropriations and Actual Water used for 1985 in the Hydrographic Areas Making up the Oasis valley Subbasin
3.1.2.2.8-2	Nevada Test Site Water Wells Located in Ash Meadows Subbasin
3.1.2.2.8-3	Perennial Yield, Total Appropriations, and Actual Water Use for 1985 in the Hydrographic Areas Making up the Ash Meadows Subbasin
3.1.2.2.8-4	Public Water Suppliers in the Community of Amargosa Valley
3.1.2.2.8-5	Nevada Test Site Water Wells Located in Alkali Flat-Furnace Creek Ranch Subbasin
3.1.2.2.8-6	Perennial Yield, Total Appropriations and Actual Water Used for 1985 in the Hydrographic Areas Making up the Alkali Flat-Furnace Creek Ranch Subbasin
3.1.2.2.9-1	Water Use Estimate for Yucca Mountain Site Characterization Project (modified from State of Nevada, Exhibit #40, 1992)

Date: 03/31/95

LIST OF TABLES (continued)

3.1.2.3.1-1	Summary of Selected Wells Monitored for Water Levels at Yucca Mountain
3.1.2.3.7-1	Environmental Isotope Data for Groundwater Samples from the Tuff Aquifer Under the Exploratory Block and its Immediate Area
3.1.2.3.9-1	Pumping Test and Water Level Data for Wells J-12 and J-13 from 1960 through 1969
3.1.2.3.9-2	Water Production from Wells J-12 and J-13 from 1983 through 1985 ^{a,b}
3.1.2.3.9-3	Pumpage from Well J-13 for Site Characterization Purposes, as Reported to the State Engineers
3.1.4.1.1-1	List of All Active Regional Weather Stations, Managing Agency, Parameters Measured, Location, Sampling and Averaging Frequency, and Date Installed [INN 3.1.4.1.1-2]
3.1.4.1.1.2.1-1	Temperature Data for Sites at and Around Yucca Mountain [INN 3.1.4.1.1.2.1-1]
3.1.4.1.1.2.2-1	Precipitation Located in the Vicinity of Yucca Mountain [INN 3.1.4.1.1.2.2-1]
3.1.4.1.1.2.3-1	Relative Humidity Data for Yucca Flat, Nevada (1962-1971)
3.1.4.1.1.2.3-2	Summary of Various Relative Humidity Data in the Vicinity of Yucca Mountain [INN 3.1.4.1.1.2.3-1]
3.1.4.1.1.2.3-3	Wet Bulb Depression Data in relation to Ambient Temperature and Humidity Values [INN 3.1.4.1.1.2.3-2]
3.1.4.1.1.2.5.1-1	Yucca Flat Upper Air Data for 1,524 m Above Mean Sea Level (328 m above ground level) [INN 3.1.4.1.1.2.5.1-1]
3.1.4.1.1.2.5.1-2	Yucca Flat Upper Air Data for 1,829 m Above Mean Sea Level (633 m above ground level) [INN 3.1.4.1.1.2.5.1-2]
3.1.4.1.1.2.5.1-3	Summary Data for Upper Air Winds [INN 3.1.4.1.1.2.5.1-3]
3.1.4.1.1.2.6-1	Monthly Atmospheric Pressure, Means, and Extremes [INN 3.1.4.1.1.2.6-1]
3.1.4.1.1.2.7-1	Monthly and Daily Average Insolation [INN 3.1.4.1.1.2.7.1]

Date: 03/31/95

LIST OF TABLES (continued)

3.1.4.1.1.2.8-1	Frequency of Occurrence of Hail at Yucca Mountain [INN 3.1.4.1.1.2.8-6]
3.1.4.1.1.2.8-2	Frequency of Occurrence of Fog and Sandstorms at Yucca Mountain [INN 3.1.4.1.1.2.8-7]
3.1.4.1.1.2.9-1	Annual Extreme Wind Speed at 30 ft (9.1 m) Above Ground Level and Probability of Occurrence of Yucca Flat, Nevada [INN 3.1.4.1.1.2.9-1]
3.1.4.1.1.2.9-2	Extreme Wind Speeds and Probability of Occurrence at Yucca Mountain [INN 3.1.4.1.1.2.9-1]
3.1.4.1.1.2.9-3	Historical Peak Wind Gusts Data for Yucca Flat, Nevada [INN 3.1.4.1.1.2.9-1]
3.1.4.1.1.2.9-4	Measured Temperature Extremes at Yucca Mountain [INN 3.1.4.1.1.2.9-2]
3.1.4.1.1.2.9-5	One and 24-hour Maximum Precipitation and Associated Probabilities of Occurrence [INN 3.1.4.1.1.2.9-3]
3.1.4.1.2-1	List of Meteorological Monitoring Site Locations [INN 3.1.4.1.2-1]
3.1.4.1.2-2	Meteorological Parameters Monitored and Measurement Height (m) at Each Station (With Accuracy)
3.1.4.1.3-1	Significant Features of Stability Distributions [INN 3.1.4.1.3-2]

LIST OF FIGURES

- 3.1.1.1.2-1 Generalized Regional Stratigraphic Column Showing Geologic Formations and Hydrogeologic Units in the Nevada Test Site Area
- 3.1.1.1.2.1-1 Distribution of Lower and Middle Proterozoic Crystalline Rocks and Middle Upper Proterozoic Restricted Basin Deposits in the Great Basin
- 3.1.1.1.2.2-1 Latest Precambrian Through Mid-Paleozoic Paleogeography of the Great Basin
- 3.1.1.1.2.4-1 Late Devonian and Mississippian Paleogeography of the Great Basin
- 3.1.1.1.2.5-1 Major Mesozoic Thrust Faults in Southern Nevada
- 3.1.1.1.2.7-1 Calderas of the Southwest Nevada Volcanic Field Near Yucca Mountain
- 3.1.1.1.3.1-1 Schematic (Modified from Stewart, 1980, and Scott, 1990) Illustrating some of the Mechanisms and Geometric Configurations Proposed for Extensional Faulting in the Basin and Range
- 3.1.1.1.3.1.1-1 Sketch Map of the Western U.S. Showing Some Major Structural Features
- 3.1.1.1.3.1.2-1 Sketch Map of the Walker Lane Belt [INN 3.1.1.1.3.1.2-1]
- 3.1.1.1.3.2.1-1 The Southwest Nevada Volcanic Field
- 3.1.1.1.4.1-1 Map Showing Major Tectonic Elements in the Western Great Basin and Boundary Region [INN 3.1.1.1.4.1-2]
- 3.1.1.1.4.1-2 Map of the Great Basin Province Showing Seismic Source Zones
- 3.1.1.1.4.1-3 Seismicity in Southern California. Earthquakes ($M \geq 4$) recorded by the Southern California Seismic Network (CIT) from 1932 to 1987
- 3.1.1.1.4.2-1 Map of the Garlock Fault Zone
- 3.1.1.1.4.2.1-1 Magnitude 5 or Greater Earthquakes within 200 Miles of Yucca Mountain
- 3.1.1.1.4.2.1-2 Time-Dependent Magnitude Completeness Thresholds for Regional Seismic Networks Covering the Great Basin

Date: 03/31/95

LIST OF FIGURES (continued)

- | | |
|------------------|---|
| 3.1.1.1.4.2.1-3 | Focal Depth Distribution for Various Source Regions in the Great Basin |
| 3.1.1.1.4.2.1-4 | Map of a Portion of the Western Great Basin Showing Seismic Gaps Located in the SNGBZ, CNSB, and the GFZ |
| 3.1.1.1.4.2.1-5 | Map of Surface Faulting in the Northern CNSB |
| 3.1.1.1.4.2.1-6 | Map Showing Earthquake Locations and Their Focal Mechanisms Computed by Body-Waveform Inversion for Great Basin Earthquakes Having $M \geq 5.0$ for the Time Period 1932 through 1986 |
| 3.1.1.1.4.2.1-7 | Map Showing Earthquake Locations and Their Focal Mechanisms Computed from First-Motion P-Wave Arrivals at Local Seismograph Networks in the Great Basin and Garlock Fault Zone |
| 3.1.1.1.4.2.2-1 | Map of Historic (Red), Holocene (Shaded Red), and Late Quaternary (Gray) Faulting in Nevada and Vicinity |
| 3.1.1.1.4.2.2-2 | Surface Ruptures from the 1872 Owens Valley Earthquake |
| 3.1.1.1.4.2.2-3 | Surface Ruptures and Focal Mechanisms from the 1932 Cedar Mountain Earthquake |
| 3.1.1.1.4.2.2-4 | Focal Mechanisms for Earthquakes in the Excelsior Mountain Region |
| 3.1.1.1.4.2.2-5 | Surface Ruptures and Focal Mechanisms for Earthquakes in the 1954 Rainbow Mountain-Stillwater Sequence |
| 3.1.1.1.4.2.2-6 | Surface Ruptures and Focal Mechanisms for Earthquakes in the Fairview Peak-Dixie Valley Sequence |
| 3.1.1.1.4.2.2-7 | Caliente-Clover Mountain Earthquake. Focal Mechanism from Smith and Sbar (1974) |
| 3.1.1.1.4.2.2-8 | Geologic Map of the Long Valley Region with Earthquake Focal Mechanisms |
| 3.1.1.1.4.2.2-9 | Surface Ruptures and Focal Mechanisms for 1986 Chalfant Valley Earthquake Sequence |
| 3.1.1.1.4.2.2-10 | Epicentral Region of the 1992 Landers, California, Earthquake |
| 3.1.1.1.5-1 | Major Elements of Mineral-Resource Classification |

Date: 03/31/95

LIST OF FIGURES (continued)

- 3.1.1.1.5.2.1-1 Map Showing Distribution of Paleozoic Rocks in Roberts Mountains Thrust Plate after Mississippian Thrusting
- 3.1.1.1.5.2.1-2 Map Showing the Distribution of Ore Deposits Dated by Potassium-Argon Dating Methods, Lithologies of the Host Rock, and Approximate Production of Gold
- 3.1.1.1.5.2.1-3 Calderas Within the Southwestern Nevada Volcanic Field
- 3.1.1.1.5.2.2-1 Bedrock Map Showing Locations of the Sterling, Daisy, Silicon, Harvey (Telluride), Tip Top, and Thompson Mines Relative to the Proposed Repository Site
- 3.1.1.1.5.3-1 Hot Springs, Geothermal Wells, and Low-Temperature Thermal Resources in Nevada
- 3.1.1.1.5.3-2 Regional Heat Flow and Distribution of Hydrothermal Systems. Abbreviations are BMH for Battle Mountain High, EL for EL, IB for Idaho Batholith, SRP for Eastern and Central Snake River Plain, Y for Yellowstone Thermal Area, RGR for Rio Grande Rift, and SAFZ for San Andreas Fault Zone
- 3.1.1.1.5.5-1 Idealized Model of Epithermal Precious-Metal Deposits
- 3.1.1.2.2.3-1 Index Map Showing the Locations of Selected Drillholes in the Vicinity of Yucca Mountain and the Locations of Cross Sections Shown on Figures 3.1.1.2.2.3-2 and 3.1.1.2.2.3-3
- 3.1.1.2.2.3-2 North-South Stratigraphic Cross Section Between Selected Drillholes at Yucca Mountain
- 3.1.1.2.2.3-3 East-West Stratigraphic Cross Section Between Selected Drillholes at Yucca Mountain
- 3.1.1.2.2.5-1 Map of Surficial Sedimentary and Volcanic Deposits in the Yucca Mountain Area. Map units are shown on Figure 3.1.1.2.2.5-2
- 3.1.1.2.2.5-2 Quaternary Units Present in the Yucca Mountain Area and Mapped on Figure 3.1.1.2.2.5-1
- 3.1.1.2.3.2-1 Preliminary Generalized Map of Known and Suspected Quaternary Faults Within 100 km of Yucca Mountain (modified from Piety et al., 1992)

LIST OF FIGURES (continued)

{This figure will be revised as per Piety et al. (1993-in review), which is tentatively planned to include a regional map of Quaternary faults within 100 km of Yucca Mountain [INN 3.1.1.2.3.2-1]}

- 3.1.1.2.3.2-2 Generalized Map of Quaternary Faults and Pliocene/Quaternary Basalts in the Yucca Mountain Vicinity (modified after Ramelli et al., 1991). Hachures show the location of the proposed repository
- {This figure will be revised as per Simonds et al. (in preparation), which is a map of known or suspected Quaternary faults within the Yucca Mountain vicinity [INN 3.1.1.2.3.2-1]}
- 3.1.1.2.3.2-3 (A) Map of Bedrock Structural Features Within and Surrounding the Proposed Repository at Yucca Mountain; and, (B) Geologic Map of the Antler Ridge Area Along the Ghost Dance Fault Zone (modified from Spengler et al., 1993)
- 3.1.1.2.3.2-4 Map of the Bare Mountain Fault on the East Side of Bare Mountain (modified after Reheis, 1988). Faults with no bar and ball are down to the south or east.
- 3.1.1.2.3.5-1 Digital Satellite Image Showing the Location of the Potential Yucca Mountain Site and the Distribution Numbered contour lines locate the position of arcuate, migrating fronts of silici volcanism during increments of Cenozoic time.
- 3.1.1.2.3.5.1-1 The Southwest Nevada Volcanic Field (after Byer et al., 1989).
- 3.1.1.2.3.5.1-2 Migration of Volcanism in Southern Nevada and the Amazmatic Gap [INN 3.1.1.2.3.5.1-1]
- 3.1.1.2.3.5.1-3 Time Transgressive, Mid-Cenozoic Volcanism of the Basin-Range Province (after Farmer et al., 1989)
- 3.1.1.2.3.5.2.1-1 Caldera-related Volcanic Activity of the Ring-Fracture Zone of the Timber Mountain Caldera Complex
- 3.1.1.2.3.5.2.1-2 Description of the BSE
- 3.1.1.2.3.5.2.2-1 Post-Caldera Basalt of the Yucca Mountain region.
- 3.1.1.2.3.5.2.2-2 Generalized Geologic Map of the Basalt of Southeast Crater Flat [INN 3.1.1.2.3.5.2.2-1]

Date: 03/31/95

LIST OF FIGURES (continued)

- 3.1.1.2.3.5.2.2-3 Generalized Geologic Map of the Little Black Peak Volcanic Center of the Basalt of Sleeping Butte.
- 3.1.1.2.3.5.2.2-4 Generalized Geologic Map of the Hidden Cone Center of the Basalt of Sleeping Butte
- 3.1.1.2.4.1-1 Map of Regional Seismicity (Quaternary Faults)
[INN 3.1.1.2.4.1-1]
- 3.1.1.2.4.2.2-1 Location of Seismic Recording Stations of the Southern Great Basin
[INN 3.1.1.2.4.2.2-1]
- 3.1.1.2.4.2.2-2 Stations Recording the Little Skull Mountain, Nevada Earthquake of 29 June 1992 in Southern Nevada [INN 3.1.1.2.4.2.2-2]
- 3.1.1.2.4.2.2-3 Attenuation of Peak Acceleration and Peak Velocity of the Little Skull Mountain, Nevada Earthquake of 29 June 1992 in Southern Nevada, Compared with the Average of the Estimates Derived from Joyner and Boor (1988) and Campbell (1990) [INN 3.1.1.2.4.2.2-3]
- 3.1.1.2.4.2.2-4 Response Spectral Velocity at 5% Damping Recorded at Lathrop Wells (epicentral distance 15 km) during the Little Skull Mountain, Nevada Earthquake of 29 June 1992 in Southern Nevada, Compared with the Average of the Estimates Derived from Joyner and Boor (1988) and Campbell (1990)
- 3.1.1.2.4.2.2-5 Locations of the Little Skull Mountain Earthquake, the Rock Valley Earthquake, and the Recording Station at Midway Valley [INN 3.1.1.2.4.2.2-4]
- 3.1.1.2.4.2.2-6 Velocity Seismograms of the Little Skull Mountain Aftershock of May 9, 1993 (magnitude 3.2, depth 9.5 km) and the Rock Valley earthquake of May 30, 1993 (magnitude 4.0, depth 0 km)
- 3.1.1.2.4.2.2-7 Velocity Seismograms of the Eureka Valley Aftershock of June 8, 1993 (magnitude 3.9, depth 5.9 km) [INN 3.1.1.2.4.2.2-5]
- 3.1.1.2.4.2.2-8 Velocity Seismograms of the Eureka Valley Aftershock of June 8, 1993 (magnitude 4.0, depth 1.7 km) [INN 3.1.1.2.4.2.2-6]
- 3.1.1.2.4.2.2-9 Location Map Showing Nevada Test Site, Yucca Mountain Seismic Stations (open squares), Explosion Locations (solid symbols), and Velocity Profiles PM1, PM2, and YF1 [INN 3.1.1.2.4.2.2-7]

Date: 03/31/95

LIST OF FIGURES (continued)

- 3.1.1.2.4.2.2-10 Location Map of Strong Motion Recording Stations at Yucca Mountain
- 3.1.1.2.4.2.2-11 Ratios of Measured PSRV at Station W-14 to Average Values for NTS Sites [INN 3.1.1.2.4.2.2-8]
- 3.1.1.2.4.2.2-12 Ratios of Measured PSRV at Station W-23 to Average Values for NTS Sites [INN 3.1.1.2.4.2.2-9]
- 3.1.1.2.4.2.2-13 Ratios of Measured PSRV at Station W-22 to Average Values for NTS Sites [INN 3.1.1.2.4.2.2-10]
- 3.1.1.2.4.2.2-14 Ratios of Measured PSRV at Station W-21 to Average Values for NTS Sites [INN 3.1.1.2.4.2.2-11]
- 3.1.1.2.4.2.2-15 Location Map of Strong Motion Stations that Recorded the Pipkin Nuclear Explosion at Pahute Mesa [3.1.1.2.4.2.2-12]
- 3.1.1.2.4.2.2-16 Profile of Radial Velocity Time Histories of the Pipkin Nuclear Explosion at Pahute Mesa Recorded to the South at Stations Shown in Figure 3.1.1.2.4.2.2-15 [INN 3.1.1.2.4.2.2-13]
- 3.1.1.2.4.2.2-17 Velocity Models for Travel Paths PM1, PM2, and YF1 Shown in Figure 3.1.1.2.4.2.2-9
- 3.1.1.2.4.3.4-1 Seismograms Recorded in a Downhole Array at Jackass Flats (Station 10, Well J-11) from a Nuclear Explosion at Pahute Mesa [INN 3.1.1.2.4.3.4-1]
- 3.1.1.2.4.3.4-2 Location Map of Downhole Ground Motion Recordings Stations at Yucca Mountain and regional topography [INN 3.1.1.2.4.3.4-2]
- 3.1.1.2.4.3.4-3 Top: Seismograms from the September 2, 1992 Magnitude 5.9 Earthquake in Southern Utah Recorded at Little Skull Mountain Seismic Stations RXTN (tunnel) and RLSM (above tunnel) of the Above Seismograms
- 3.1.1.2.4.3.4-4 Seismograms from a September 7, 1992 M 3.15 Earthquake in Southern Utah Recorded at Little Skull Mountain Seismic Stations RXTN (tunnel) and RLSM (above tunnel)
- 3.1.1.2.7.1-1 Location of Existing Boreholes for Geoengineering Database
- 3.1.1.2.7.1.1-1 Thermomechanical and Geologic Stratigraphy at Hole USW G-4

Date: 03/31/95

LIST OF FIGURES (continued)

- 3.1.1.2.7.3.1-1 Representative Axial Stress-Axial Strain Plot for Welded Devitrified Topopah Spring Member (Test Sample GU-3 1050.4/3; Test Conditions Ambient Temperature and Pressure, Strain Rate 10^{-5} /s)
- 3.1.1.2.7.3.1-2 Stress-strain Curves from Compressive Tests on Oven-dried samples of Topopah Spring Tuff from Busted Butte at 0 MPa Confining Pressure, 22°C Temperature and 10^{-5} Per Second Strain Rate
- 3.1.1.2.7.3.1-3 Stress-strain Curves from Compressive Tests on Oven-dried Samples of Topopah Spring Tuff from Busted Butte at 5 MPa Confining Pressure, 22°C Temperature and 10^{-5} Per Second Strain Rate
- 3.1.1.2.7.3.1-4 Stress-strain Curves from Compressive Tests on Oven-dried Samples of Topopah Spring Tuff from Busted Butte at 10 MPa Confining Pressure, 22°C Temperature and 10^{-5} Per Second Strain Rate
- 3.1.1.2.7.3.1-5 Stress-strain Curves from Compressive Tests on Saturated Samples of Topopah Spring Tuff from Busted Butte at 0 MPa Confining Pressure, 22°C Temperature and 10^{-5} Per Second Strain Rate
- 3.1.1.2.7.3.1-6 Stress-strain Curves from Compressive Tests on Saturated Samples of Topopah Spring Tuff from Busted Butte at 5 MPa Confining Pressure, 22°C Temperature and 10^{-5} Per Second Strain Rate
- 3.1.1.2.7.3.1-7 Stress-strain Curves from Compressive Tests on Saturated Samples of Topopah Spring Tuff from Busted Butte at 10 MPa Confining Pressure, 22°C Temperature and 10^{-5} Per Second Strain Rate
- 3.1.1.2.7.3.1-8 Stress-strain Curves from Compressive Tests on Saturated Samples of Topopah Spring Tuff from Busted Butte at 0 MPa Confining Pressure, 150°C Temperature and 10^{-5} Per Second Strain Rate
- 3.1.1.2.7.3.1-9 Stress-strain Curves from Compressive Tests on Saturated Samples of Topopah Spring Tuff from Busted Butte at 5 MPa Confining Pressure, 150°C Temperature and 10^{-5} Per Second Strain Rate
- 3.1.1.2.7.3.1-10 Young's Modulus Vs. Functional Porosity (After Price and Bauer, 1985)
- 3.1.1.2.7.3.2-1 Compressive Strength Versus Sample Size
- 3.1.1.2.7.3.2-2 Effect of Saturating Samples on Comprehensive Strength

LIST OF FIGURES (continued)

- 3.1.1.2.7.4.5-1 Plot of the Coefficient of Friction Against Log Sliding Velocity for Oven-Dried and Water-Saturated Joints for Grouse Canyon Member Welded Tuff
- 3.1.1.2.7.4.5-2 Shear Stress Versus Shear Displacement for Oven-Dried Grouse Canyon Member Welded Tuff Sample for 60 and 2,400 s. Periods of Static Contact
- 3.1.1.2.7.4.5-3 Plot of Static Coefficient of Friction Against the Log Time of Contact for Oven-Dried and Water-Saturated Joints in Grouse C Canyon Member Welded Tuff
- 3.1.1.2.7.6.2.1-1 Selection Process for Mechanical Numerical Models [INN 3.1.1.2.7.6.2.1-1]
- 3.1.2.1.1-1 Hydrographic Study Area, Showing the Eight Hydrographic Areas and Major Stream Channels
- 3.1.2.1.1-2 Locations of Crest-stage Sites in the Hydrologic Study Area and Adjacent Areas
- 3.1.2.1.1-3 Surface-Water Bodies Including Springs [INN 3.1.2.1.1-3]
- 3.1.2.1.2-1 Regional Surface Water Monitoring Network
- 3.1.2.1.2-2 Site Surface-Water Monitoring Network
- 3.1.2.1.5-1 Flood-Prone Areas in the Vicinity of Fortymile Wash
- 3.1.2.1.5-2 Site Topography and Flood Potential Areas
- 3.1.2.2.1.2-1 Recharge, Discharge, and Hydrographic Areas
- 3.1.2.2.1.2-2 Hydrogeologic Study Area Showing Three Groundwater Subbasins
- 3.1.2.2.1.2-3 Regional and Subregional Hydrologic Model Boundaries
- 3.1.2.2.1.2-4 Potentiometric Levels in Cenozoic Rocks and Boundary Conditions for Two Dimensional, Sub-Regional Model of Groundwater Flow
- 3.1.2.2.2-1 Yucca Mountain Site Characterization Project Regional Water Level and Spring-Discharge Sites for Environmental Monitoring
- 3.1.2.2.2-2 Potentiometric Surface Map, Yucca Mountain

Date: 03/31/95

LIST OF FIGURES (continued)

- 3.1.2.2.2-3 Potentiometric Levels in Pre-Tertiary Rocks, Yucca Mountain Region
- 3.1.2.2.3-1 Semilog Graphs of Drawdown and Residual Drawdown of Water Level During Pumping Test in Test Well 67-73, February 24-26, 1963
- 3.1.2.2.3-2 Semilog Graphs of Drawdown and Residual Drawdown of Water Level During Pumping Test in Test Well 67-68, September 11-14, 1962
- 3.1.2.2.3-3 Semilog Graphs of Drawdown and Residual Drawdown of Water Level During Pumping Test in Test Well 66-75, September 11-13, 1962
- 3.1.2.2.3-4 Semilog Graphs of Drawdown and Residual Drawdown of Water Level During Pumping Test in Test Well 88-66, March 16-20, 1962
- 3.1.2.2.3-5 Water-Level Drawdown, Pumping Test 2, Depth Interval 1,297 to 1,805 Meters
- 3.1.2.2.3-6 Residual Drawdown, Recovery Test 2, Depth Interval 1,297 to 1,805 Meters
- 3.1.2.2.3-7 Analysis of Adjusted Water-Level Drawdown, Pumping Test 2, Depth Interval 1,297 to 1,805 Meters, Theis Method
- 3.1.2.2.3-8 Analysis of Adjusted Water-Level Drawdown, Pumping Test 2, Depth Interval 1,297 to 1,805 Meters, Straight-Line Method
- 3.1.2.2.3-9 Drawdown and Analysis of Drawdown During Step-Drawdown Test of Pumping Test 1, Stallman's Method
- 3.1.2.2.3-10 Drawdown and Analysis of Drawdown During Pumping Test 3, Straight-Line Method
- 3.1.2.2.3-11 Analysis of Water-Level Drawdown, Pumping Test 1, Depth Interval 382 to 1,301 Meters, Theis Method
- 3.1.2.2.3-12 Analysis of Water-Level Drawdown, Pumping Test 1, Depth Interval 382 to 1,301 Meters, Straight-Line Method
- 3.1.2.2.3-13 Analysis of Residual Drawdown, Recovery Test 1, Depth Interval 382 to 1,301 Meters, Straight-Line Method
- 3.1.2.2.3-14 Drawdown in Well USW VH-1 During Test 3

LIST OF FIGURES (continued)

- | | |
|--------------|---|
| 3.1.2.2.3-15 | Drawdown in Well USW VH-1 During Test 5 |
| 3.1.2.2.3-16 | Recovery in Well USW VH-1 During Test 4 |
| 3.1.2.2.3-17 | Recovery in Well USW VH-1 During Test 6 |
| 3.1.2.2.3-18 | Drawdown in Test Wells UE-25b#1 and UE-25a#1 During Pumping Test 3 |
| 3.1.2.2.3-19 | Analysis of Water-Level Drawdown, Pumping Test 1, Zone from 572 to 688 Meters in the Well, Theis Method |
| 3.1.2.2.3-20 | Analysis of Water-Line Drawdown, Pumping Test 1, Zone from 572 to 688 Meters in the Well, Straight-Line Solution |
| 3.1.2.2.3-21 | Analysis of Water-Level Recovery, Pumping Test 1, Zone from 572 to 688 Meters in the Well, Straight-Line Solution |
| 3.1.2.2.3-22 | Analysis of Water-Line Drawdown, Pumping Test 2, Zone from 687 to 1,879 Meters in the Well, Theis Method |
| 3.1.2.2.3-23 | Analysis of Water-Level Drawdown, Pumping Test 2, Zone from 687 to 1,829 Meters in the Well, Straight-Line Solution |
| 3.1.2.2.3-24 | Analysis of Water-Level Drawdown, Pumping Test 3, Zone from 687 to 1,829 Meters in the Well, Theis Method |
| 3.1.2.2.3-25 | Analysis to Water-Level Drawdown, Pumping Test 3, Zone from 687 to 1,829 Meters in the Well, Straight-Line Solution |
| 3.1.2.2.3-26 | Analysis of Water-Level Recovery, Pumping Test 2, Zone from 687 to 1,829 Meters in the Well, Straight-Line Solution |
| 3.1.2.2.3-27 | Analysis of Water-Line Recovery, Pumping Test 3, Zone from 687 to 1,829 Meters in the Well, Straight-Line Method |
| 3.1.2.2.3-28 | Analysis of Water-Level Recovery Following Second Cycle of Pumping of the Interval from 754 to 1,219 Meters, Using the Straight-Line Method |
| 3.1.2.2.3-29 | Analysis of the Pumping Test of the Interval from 754 to 1,219 Meters, Using Brown's Method for a Cyclically Pumped Well |
| 3.1.2.2.3-30 | Analysis of Water-Level Drawdown of the Interval from 822 to 1,219 Meters, Using the Theis Method |

Date: 03/31/95

LIST OF FIGURES (continued)

- 3.1.2.2.3-31 Analysis of Water-Level Drawdown Versus Time for Pumping Test 6, Depth Interval from 519 to 1,219 Meters, Using the Straight-Line Method of Analysis
- 3.1.2.2.3-32 Analysis of Water-Level Recovery Versus Time for Pumping Test 6, Depth Interval from 519 to 1,219 Meters
- 3.1.2.2.3-33 Water-Level Drawdown, Pumping Test 3, Depth Interval From 704 to 1,219 Meters
- 3.1.2.2.3-34 Water-Level Drawdown, Pumping Test 4, Depth Interval from 704 to 1,219 Meters
- 3.1.2.2.3-35 Data for Pumping and Recovery Tests 4, Depth Interval from 704 to 1,219 Meters
- 3.1.2.2.3-36 Analysis of Late-Time Data, Pumping Test 4, Depth Interval from 704 to 1,219 Meters, Straight-Line Method
- 3.1.2.2.3-37 Analysis of Adjusted Water-Level Drawdown, Pumping Test 4, Depth Interval from 704 to 1,219 Meters, Theis Method (Lohman, 1972)
- 3.1.2.2.3-38 Analysis of Adjusted Water-Level Drawdown, Pumping Test 4, Depth Interval from 704 to 1,219 Meters, Method of Neuman (1975)
- 3.1.2.2.3-39 Analysis of Residual Drawdown, Recovery Test 4, Depth Interval from 704 to 1,219 Meters, Straight-Line Method
- 3.1.2.2.3-40 Analysis of Pumping Test 3, Depth Interval from 704 to 1,219 Meters, Vertical-Fracture Model, Curve-Match Method
- 3.1.2.2.3-41 Analysis of Pumping Test 4, Depth Interval from 704 to 1,219 Meters, Vertical-Fracture Model, Curve-Match Method
- 3.1.2.2.3-42 Analysis of Recovery Test 4, Depth Interval from 704 to 1,219 Meters, Vertical-Fracture Model, Curve-Match Method
- 3.1.2.2.3-43 Analysis of Pumping Test 4, Depth Interval from 704 to 1,219 Meters, Vertical-Fracture Model, Bilinear-Flow Method
- 3.1.2.2.3-44 Analysis of Pumping Test 3, Depth Interval from 704 to 1,219 Meters, Vertical-Fracture Model, Linear-Flow Method
- 3.1.2.2.3-45 Analysis of Pumping Test 4, Depth Interval from 704 to 1,219 Meters, Vertical-Fracture Model, Linear-Flow Method

Date: 03/31/95

LIST OF FIGURES (continued)

- 3.1.2.2.3-46 Analysis of Recovery Test 3, Depth Interval from 704 to 1,219 Meters, Vertical-Fracture Model, Linear-Flow Method
- 3.1.2.2.3-47 Analysis of Recovery Test 4, Depth Interval from 704 to 1,219 Meters, Vertical-Fracture Model, Linear-Flow Method
- 3.1.2.2.3-48 Analysis of Recovery Test 4, Depth Interval from 704 to 1,219 Meters, Vertical-Fracture Model, Bilinear-Flow Method
- 3.1.2.2.3-49 Analysis of Water-Level Drawdown, Pumping Test 1: Depth Interval from 526 to 1,220 Meters; Theis Method
- 3.1.2.2.3-50 Analysis of Water-Level Drawdown, Pumping Test 1: Depth Interval from 526 to 1,220 Meters; Straight-Line Solution with Dual-Porosity Model
- 3.1.2.2.3-51 Analysis to Water-Level Drawdown, Pumping Test 2: Depth Interval from 526 to 1,220 Meters; Straight-Line Solution with Dual-Porosity Model
- 3.1.2.2.3-52 Water-Level Recovery, Pumping Test 2: Depth Interval from 526 to 1,220 Meters
- 3.1.2.2.3-53 Analysis of Water-Level Drawdown, Pumping Test 3: Depth Interval from 753 to 834 Meters; Straight-Line Solution with Dual-Porosity Model
- 3.1.2.2.3-54 Residual Drawdown, Recovery Test 3: Depth Interval 753 to 834 Meters
- 3.1.2.2.3-55 Water-Level Drawdown, Pumping Test 4: Depth Interval from 608 to 645 Meters
- 3.1.2.2.3-56 Water-Level Recovery, Recovery Test 4: Depth Interval from 608 to 645 Meters
- 3.1.2.2.7-1 Former High Levels of the Water Table in the South-Central Great Basin during the Quaternary Period [INN 3.1.2.2.7-1]
- 3.1.2.2.7-2 Variations in Flow-Path Length for the Ash Meadows Area in Response to Different Water Table Levels [INN 3.1.2.2.7-2]
- 3.1.2.2.8-1 Map Showing Areas of Heavy Withdrawals near Yucca Mountain
- 3.1.2.2.8-2 State Hydrographic Areas within the Hydrogeologic Study Area

Date: 03/31/95

LIST OF FIGURES (continued)

- 3.1.2.2.8-3 Potentiometric Surface of the Amargosa Desert
- 3.1.2.2.8-4 Potentiometric Maps of the Amargosa Desert (Valley Fill Aquifer)
Based on the Well Data from (1962) (A) and 1984 (B)
- 3.1.2.3.1-1 Instrumentation of Monitoring Borehole USW UZ-1 (0- to 1217.5-feet
depth). Modified from Montazer et al. (1986)
- 3.1.2.3.1-2 Unsaturated zone moisture monitoring sites (DOE, 1992)
- 3.1.2.3.1-3 Saturated zone monitoring sites (DOE, 1992)
- 3.1.2.3.2-1 Definition of Unsaturated-Zone Hydrogeologic Units and Correlation
with Rock-Stratigraphic Units
- 3.1.2.3.3.2-1 Revised potentiometric-surface map, Yucca Mountain (constructed
from mostly 1988 average water levels (Ervin et al., 1993))
- 3.1.2.3.9-1 Decline in the Water Level with Well J-13 in Continuous Service
[INN 3.1.2.3.9-1]
- 3.1.3.2.1.1-1 Index Map Showing the Location of Drill Holes in Relation to the
CPDB
- 3.1.3.2.1.1.1-1 Total Alkali Silica Diagram (Le Bas et al., 1986) for Representative
Fresh and Altered Samples of Latite and Rhyolite Tuff of the Topopah
Spring Member of the Paintbrush tuff
- 3.1.3.2.1.1.1-2 Sm-Nd Plot for Representative Samples of the Topopah Spring
Member of the Paintbrush Tuff. Note the Distinct Break Between the
Latites and Rhyolites in that the Latite has Distinctly Higher REE
Abundances and is LREE enriched (Lower Sm/Nd ratio)
- 3.1.3.2.1.1.1-3 Enrichment Diagram for Major Elements in Altered Topopah Spring
Rhyolite
- 3.1.3.2.1.1.2-1 Illustration of the Cumulative Percent of Phenocrysts and Lithic
Fragments with Depth in the Topopah Spring Member for a) Drill
Hole USW G-4 and b) UE-25 a#1
- 3.1.3.2.1.1.2-2 Illustration of the Cumulative Percent Felsic Phenocrysts with Depth
in the Topopah Spring Member for a) Drill Hole USW G-4 and b)
UE-25 a#1

Date: 03/31/95

LIST OF FIGURES (continued)

- 3.1.3.2.1.1.2-3 Illustration of the Cumulative Percent Mafic Phenocrysts with Depth in the Topopah Spring Member for a) Drill Hole USW G-4 and b) UE-25 a#1
- 3.1.3.2.1.1.2-4 Illustration of the Cumulative Percent Phases as Determined by Quantitative X-ray Diffraction with Depth in the Topopah Spring Member for: (a) Drill Hole USW G-4 and (b) UE-25 a#1
- 3.1.3.2.1.1.3-1 Illustration of the Cumulative Percentage of Matrix Textures with Depth in the Topopah Spring Member Compared to Macroscopic Welding Horizons for Drill Hole UE-25 a#1
- 3.1.3.2.1.1.3-2 Comparison of the Matrix Textures Within the Proposed Repository Horizon for Drill Holes USW G-4, UE-25 a#1, and USW GU-3
- 3.1.3.2.1.1.4-1 These Plots are an Expansion of the Horizontal Scale, to Better Illustrate the Distribution of Diagenetic Phases in the Topopah Spring Member for a) Drill Hole USW G-4 and b) UE-25 a#1
- 3.1.3.2.1.1.4-2 Ternary Plot of Exchangeable Cations in Clinoptilolite and Heulandite Zeolites in the Topopah Spring Member
- 3.1.4.1.1-1 Locations of the Climatological Data Stations in the Yucca Mountain Region [INN 3.1.4.1.1-1]
- 3.1.4.1.1-2 Locations of Site Specific Monitoring Sites at Yucca Mountain [INN 3.1.4.1.1-1]
- 3.1.4.1.1.1-1 Examples of Atmospheric Motions or "Disturbances" Shown in Context of their Relationship in Space and Time
- 3.1.4.1.1.1.2-1 Average Position of the Polar Front in January [INN 3.1.4.1.1.1.2-1]
- 3.1.4.1.1.1.2-2 Winter Weather Type A [INN 3.1.4.1.1.1.2-2]
- 3.1.4.1.1.1.2-3 Winter Weather Type B [INN 3.1.4.1.1.1.2-2]
- 3.1.4.1.1.1.2-4 Winter Weather Type C [INN 3.1.4.1.1.1.2-2]
- 3.1.4.1.1.1.2-5 Winter Weather Type D Depicted are Time-Lapse Positions of the Low-Pressure Center as it Tracks Across the Northern U.S. [INN 3.1.4.1.1.1.2-2]
- 3.1.4.1.1.1.2-6 Winter Weather Type E [INN 3.1.4.1.1.1.2-2]

Date: 03/31/95

LIST OF FIGURES (continued)

3.1.4.1.1.2-7	Summer Southwest Monsoon [INN 3.1.4.1.1.2-3]
3.1.4.1.1.3-1	Dominant Summer and Winter Moisture Sources for the Southern Nevada Area [INN 3.1.4.1.1.3-1]
3.1.4.1.1.3-2	Regression Curves Relating Annual Average Precipitation (mm) with Precipitation Gage Elevation (ft) [INN 3.1.4.1.1.3-3]
3.1.4.1.2.2-1	Precipitation Amounts [INN 3.1.4.1.2.2-2]
3.1.4.1.2.4-1 to n	Wind Rose Plot (1 - n) [INN 3.1.4.1.2.4-1]
3.1.4.1.2.5.1-1	Seasonal and Annual Wind Distribution at 5,000 ft (1.524 m) Above Mean Sea Level (328 m Above Ground Level) for Yucca Flat (1957 to 1964) [INN 3.1.4.1.2.5.1-1]
3.1.4.1.2.5.1-2	Seasonal and Annual Wind Distributions at 6,000 ft (1.829 m) Above Mean Sea Level (633 m Above Ground Level) for Yucca [INN 3.1.4.1.2.5.1-2]
3.1.4.1.2.5.1-3	Upper Air Data [INN 3.1.4.1.2.5.1-3]
3.1.4.1.2.6-1	Monthly Mean Atmospheric Pressure [INN 3.1.4.1.2.6-1]
3.1.4.1.2.6-2	Hourly Mean Atmospheric Pressure [INN 3.1.4.1.2.6-2]
3.1.4.1.2.8-1	Pattern of Detected Lightening [INN 3.1.4.1.2.8-3]
3.1.4.1.2.8-2	Spatial Relationships Between Lightening-Strike Data and Rainfall-Runoff Data [INN 3.1.4.1.2.8-5]
3.1.4.1.3-1	Wind Rose Plot [INN 3.1.4.1.3-1]
3.1.4.1.3-2	Wind Rose Plot [INN 3.1.4.1.3-1]
3.1.4.1.3-3	Wind Rose Plot [INN 3.1.4.1.3-1]
3.1.4.1.3-4	Wind Rose Plot [INN 3.1.4.1.3-1]
3.1.4.1.3-5	Wind Rose Plot [INN 3.1.4.1.3-1]
3.1.4.1.3-6	Wind Rose Plot [INN 3.1.4.1.3-1]
3.1.4.1.3-7	Wind Rose Plot [INN 3.1.4.1.3-1]

LIST OF INFORMATION NEEDS

- 3.1.1.1.3.1.2-1 Map Sketch of Walker Lake Belt and associated faults and earthquakes.
- 3.1.1.1.3.3-1 Report on Alternative Tectonic Models
- 3.1.1.1.4.1-1 Seismic Hazard Methodology
- 3.1.1.1.4.1-2 A Regional map showing the major seismotectonic elements in the western great basin with an overlay of regional seismicity.
- 3.1.1.1.4.2.1-1 Southern Great Basin Seismic Network Catalog. Figure showing the distribution of seismicity on a regional scale (322 km).
- 3.1.1.2.2.2-1 Additional information on the stratigraphy and distribution of Pre-Cenozoic aged rocks beneath Yucca Mountain.
- 3.1.1.2.2.3-1 Additional data on the volcanic stratigraphy at Yucca Mountain.
- 3.1.1.2.2.3-2 Additional data on the Calico Hills stratigraphic section.
- 3.1.1.2.2.5-1 Additional data on Quaternary stratigraphy at Yucca Mountain.
- 3.1.1.2.3.2-1 Maps of Quaternary faults (site and regional scale). Figure -1: A preliminary map of known and suspected quaternary faults within 100 km of Yucca Mountain Figure -2: A preliminary map of known and suspected quaternary faults in the vicinity of Yucca Mountain.
- 3.1.1.2.3.5.1-1 Additional information on silicic volcanism in the YMR.
- 3.1.1.2.3.5.2.1-1 Caldera-related volcanic activity of the ring-fracture zone of the Timber Mountain caldera complex.
- 3.1.1.2.3.5.2.2-1 Generalized geologic map of the basalt of southeast Crater Flat.
- 3.1.1.2.3.5.2.2-2 K-Ar and $^{40}\text{Ar}/^{39}\text{Ar}$ age determinations for the Quaternary basalt of Crater Flat and Buckboard Mesa.
- 3.1.1.2.3.5.2.2-3 Map and cross section showing the generic (feeder and vent) relationships between Crater Flat basalt centers and feeder dikes.
- 3.1.1.2.3.5.2.2-4 Data to verify the stratigraphic position of the western lava flow associated with the Hidden Cone Center.

LIST OF INFORMATION NEEDS (continued)

- 3.1.1.2.4.1-1 Data from the UNR Northern Nevada and Southern Great Basin networks; Map of quaternary faults (unpublished).
- 3.1.1.2.4.2.1-1 Detailed Map of the Ghost Dance fault.
- 3.1.1.2.4.2.2-1 Location of seismic recording stations of the Southern Great Basin Seismic Network.
- 3.1.1.2.4.2.2-2 Stations recording the Little Skull Mountain earthquake of 29 June, 1992 in southern Nevada.
- 3.1.1.2.4.2.2-3 Attenuation of peak acceleration and peak velocity of the Little Skull Mountain, Nevada earthquake of 29 June, 1992 in southern Nevada compared with the average of the estimates derived from Joyner and Boore (1988) and Campbell (1990).
- 3.1.1.2.4.2.2-4 Locations of the Little Skull Mountain earthquake, the Rock Valley earthquake, and the recording station at Midway Valley.
- 3.1.1.2.4.2.2-5 Velocity seismograms of the Eureka Valley aftershock of June 3, 1993 (magnitude 3.9, depth 5.9 km).
- 3.1.1.2.4.2.2-6 Velocity seismograms of the Eureka Valley aftershock of June 8, 1993 (magnitude 4.0, depth 1.7 km) .
- 3.1.1.2.4.2.2-7 Ratios of measured PSRV at Station W-14 to average values for NTS sites.
- 3.1.1.2.4.2.2-8 Ratios of measured PSRV at Station W-23 to average values for NTS sites.
- 3.1.1.2.4.2.2-9 Ratios of measured PSRV at Station W-22 to average values for NTS sites.
- 3.1.1.2.4.2.2-10 Ratios of measured PSRV at Station W-21 to average values for NTS sites.
- 3.1.1.2.4.2.2-11 Location map of strong motion stations that recorded the Pipkin nuclear explosion at Pahute Mesa.
- 3.1.1.2.4.2.2-12 Profile of radial velocity time histories of the Pipkin nuclear explosion at Pahute Mesa recorded to the south at stations shown in Figure 3.1.1.2.4.2.2-15.

LIST OF INFORMATION NEEDS (continued)

- 3.1.1.2.4.3.4-1 Seismograms recorded in a downhole array at Jackass Flats (Station 10, Well J-11) from a nuclear explosion at Pahute Mesa .
- 3.1.1.2.4.3.4-2 Location map of downhole ground motion recording stations at Yucca Mountain and regional topography.
- 3.1.1.2.4.4-1 Table of fault parameters for faults considered to be potential seismic sources for the Yucca Mountain Site.
- 3.1.1.2.7.1.1-1 Information about the spatial location of the various units of the thermomechanical stratigraphy in and in the vicinity of the repository block.
- 3.1.1.2.7.3.1-1 Data to verify whether measurements of elastic properties of the thermomechanical units, especially the emplacement unit, made under conditions of zero confining pressure, room temperature (23°C) and full saturation (baseline conditions) are applicable to the values of these properties for in situ conditions.
- Results of tests in which the elastic properties are measured on comparable samples of the thermomechanical units under the baseline conditions as well as under the expected state of these conditions in situ.
- 3.1.1.2.7.3.1-2 Sufficient test results on the measurement of Young's Modulus and Poisson's Ratio of the various thermomechanical units to adequately characterize these properties of the repository block.
- 3.1.1.2.7.3.1-3 Sufficient test results to determine the anisotropy of elastic properties of the various thermomechanical units including values of Young's Modulus and Poisson's Ratio measured perpendicular and parallel to the rock fabric.
- 3.1.1.2.7.3.2-1 Unconfined compressive strength of the various units of the thermomechanical stratigraphy.
- 3.1.1.2.7.3.2-2 Test results on the unconfined compressive tests of various units of the thermomechanical stratigraphy under as close to the in situ moisture content as possible.
- 3.1.1.2.7.3.2-3 Effect of elevated temperatures on the strength of various units of the thermomechanical stratigraphy.

LIST OF INFORMATION NEEDS (continued)

- 3.1.1.2.7.3.2-4 Test results to evaluate the strength anistropy of TSw2.
- 3.1.1.2.7.3.2-5 Geological maps of the ESF exposures showing the locations, if any, of zones of high lithophysae content in the TSw2.
- 3.1.1.2.7.3.2-6 Test results that show the effect of lithophysae content on the mechanical properties of the Topopah Spring tuff.
- 3.1.1.2.7.3.3-1 Information on the tensile strength of the various units of the thermomechanical stratigraphy.
- 3.1.1.2.7.3.4-1 Triaxial tests on various units of the thermomechanical stratigraphy, especially TSw2 and CHn.
- 3.1.1.2.7.3.5-1 Long-term time-dependent deformational behavior of TSw2 at elevated temperatures expected in emplacement areas during the preclosure period.
- 3.1.1.2.7.4.1-1 Test results to evaluate the effect of normal stress level on the coefficient of friction of natural joints.
- 3.1.1.2.7.4.2-1 Information on the effect of infilling materials on the mechanical properties of joints.
- 3.1.1.2.7.4.3-1 a) Test results to show the differences, if any, of the mechanical properties of healed and unhealed natural joints.
- b) Test results to show the effects, if any, of various test conditions such saturation level, temperature, etc., on the mechanical properties of natural joints.
- The measured values of joint properties under various test conditions from these tests are needed.
- 3.1.1.2.7.4.5-1 Test results on the effect of short-term time-dependent factors on the mechanical properties of joints.
- 3.1.1.2.7.4.6-1 Test results showing the long-term time-dependent properties of joints at elevated temperatures expected during the preclosure period.

LIST OF INFORMATION NEEDS (continued)

- 3.1.2.1.1-1 Surface water monitoring data such as flow duration data that indicate maximum, minimum and average historical observations of surface water bodies, water quality data, snow pillow and precipitation data that is currently being recorded at all recording stations.
- 3.1.2.1.1-2 Provide information on the characteristics of playas including location, discharge and chemical quality of water.
- 3.1.2.1.1-3 Figure showing the location of all surface water bodies in the Yucca Mountain region including springs and major playas.
- 3.1.2.1.1-4 Update of phreatophyte data in Table 3.1.2.1.1-3.
- 3.1.2.1.4-1 More geologic evidence of Quaternary flooding in the region of Yucca Mountain with emphasis on the Holocene may be developed during site characterization studies.
- 3.1.2.1.5-1 Additional flooding study results.
- 3.1.2.1.5-2 Design basis water levels and elevations of all surface facilities and underground openings may be available, but could not be collected for this revision.
- 3.1.2.1.5-3 A review and reference of two T&MSS floodplain assessments, "Floodplain Assessment of Surface-Base Investigations at the Yucca Mountain Site, Nye County, Nevada" dated 8/91 and "Floodplain Assessment of Site Characterization Activities at the Yucca Mountain Site, Nye County, Nevada" dated 8/92.
- 3.1.2.2.2-1 Summary of selected wells monitored for water levels at Yucca Mountain.
- 3.1.2.2.3-1 Hydraulic properties for the Lower Carbonate Aquifer.
- 3.1.2.2.3-2 Pumping response data for the welded tuff aquifer.
- 3.1.2.2.3-3 Analyses using the finite-conductivity, vertical fracture model.
- 3.1.2.2.3-4 Aquifer test results from C-well multi-well cluster in 1995.
- 3.1.2.2.3-5 Aquifer properties from the Upper Carbonate Aquifer.

LIST OF INFORMATION NEEDS (continued)

- 3.1.2.2.4-1 Analysis and modeling results of the water table and deeper aquifer to evaluate recharge/discharge relationships.
- 3.1.2.2.5-1 Analysis and evaluation of regional groundwater ages.
- 3.1.2.2.6-1 Groundwater flow path analysis.
- 3.1.2.2.6-2 Groundwater interchange between aquifer analysis and evaluation.
- 3.1.2.2.6-3 Evaluation of geologic and aquifer parameter variability downgradient of the repository before the regulatory receptor.
- 3.1.2.2.7-1 Map or diagram showing former high levels of the water table in the south-central Great Basin during the Quaternary Period.
- 3.1.2.2.7-2 Diagram of variations in flow-path length for the Ash Meadows area in response to different water-table levels.
- 3.1.2.2.7-3 Confirmation of the reconnaissance observations of Mifflin and Wheat (1979) regarding shorelines of late Pleistocene age.
- 3.1.2.2.7-4 Evaluation of recharge along Fortymile Wash.
- 3.1.2.2.7-5 Evaluation of the apparent groundwater ages presented by Benson and McKinley (1985).
- 3.1.2.2.7-6 Age of marsh deposits in southern Indian Springs Valley that occur as much as 20 to 50 m above the modern water table in the valley-fill aquifer.
- 3.1.2.2.7-7 A quantitative interpretation of the carbon-14 data to measure ground-water velocity.
- 3.1.2.2.8-1 Update of water appropriations data used in tables.
- 3.1.2.3.1-1 A table of the unsaturated zone monitoring system composed of a network of 25 holes.
- 3.1.2.3.3.1-1 Data on UZ potentials gathered from USW UZ-series boreholes.
- 3.1.2.3.3.2-1 Reason for the flatness of the potentiometric surface in the region of the small hydrologic gradient.

LIST OF INFORMATION NEEDS (continued)

- 3.1.2.3.3.2-2 The exact reason for the low permeability of the Solitario Canyon fault and the flux that crosses the fault into the region of the proposed repository block.
- 3.1.2.3.4-1 Percolation in the unsaturated zone (surface-based study and ESF study).
- 3.1.2.3.5-1 Site ground-water recharge information.
- 3.1.2.3.7-1 Collection of data for the chemical and isotopic characterization of the infiltrating pore water as a function of depth at the site.
- 3.1.2.3.8-1 Confirmation of hydrologic characteristics of faults in the vicinity of Yucca Mountain and the generation of locally saturated areas.
- 3.1.2.3.9-1 Diagram of decline in the water level with well J-13 in continuous service.
- 3.1.2.3.10-1 Parameters used to model the hydrologic system more effectively and any variations induced by climatic or tectonic changes.
- 3.1.2.3.10-2 Results from additional paleospring investigations.
- 3.1.3.2.1-1 Analyses of Samples from additional boreholes and the ESF, Mineralogy, Petrology, and Chemistry of the Topopah Spring member.
- 3.1.3.2.1.1.1-1 Hydrothermal alteration of the Topopah Spring member.
- 3.1.4.1.1-1 Locations of the regional and site-specific meteorological monitoring stations.
- 3.1.4.1.1-2 List of parameters measured at the regional and site-specific meteorological monitoring stations.
- 3.1.4.1.1.1.2-1 Average position of the polar front in January.
- 3.1.4.1.1.1.2-2 Time-lapse movements of winter storms systems.
- 3.1.4.1.1.1.2-3 Summer southwest monsoon showing a lobe of the Bermuda high over the four corners region.

LIST OF INFORMATION NEEDS (continued)

- 3.1.4.1.1.1.3-1 Dominant summer and winter moisture sources for the southern Nevada area.
- 3.1.4.1.1.1.3-2 Effect of varying air flow regime on the Yucca Mountain Site.
- 3.1.4.1.1.1.3-3 Plot of average annual precipitation as a function of station elevation.
- 3.1.4.1.1.2.1-1 Summary data on temperature from site and regional monitoring sites.
- 3.1.4.1.1.2.2-1 Precipitation data.
- 3.1.4.1.1.2.2-2 Precipitation amounts for each month, based on average data from table.
- 3.1.4.1.1.2.3-1 Relative humidity.
- 3.1.4.1.1.2.3-2 Wet bulb depression data.
- 3.1.4.1.1.2.4-1 Surface wind data.
- 3.1.4.1.1.2.4-2 Wind roses with data split for daytime versus nighttime wind frequencies (data plotted on terrain maps).
- 3.1.4.1.1.2.5.1-1 Wind speed and directions at 1524 m above mean sea level.
- 3.1.4.1.1.2.5.1-2 Wind speed and directions at 1829 m above mean sea level.
- 3.1.4.1.1.2.5.1-3 Data from upper air winds.
- 3.1.4.1.1.2.5.1-4 Comparison of Desert Rock data with historical Yucca Flat upper air data.
- 3.1.4.1.1.2.5.2-1 Average morning and afternoon mixing height.
- 3.1.4.1.1.2.6-1 Standard atmospheric pressure.
- 3.1.4.1.1.2.7-1 Monthly and daily average insolation.
- 3.1.4.1.1.2.8-1 Evidence of tornadic weather.
- 3.1.4.1.1.2.8-2 Evidence of dust devil activity.

LIST OF INFORMATION NEEDS (continued)

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| 3.1.4.1.1.2.8-3 | Pattern of detected lightning. |
| 3.1.4.1.1.2.8-4 | Lightning data. |
| 3.1.4.1.1.2.8-5 | Spatial relationships between lightning-strike data and rainfall-runoff data. |
| 3.1.4.1.1.2.8-6 | Frequency of occurrence of hail. |
| 3.1.4.1.1.2.8-7 | Frequency of occurrence of fog and sandstorms. |
| 3.1.4.1.1.2.9-1 | Extreme wind speeds and probability of occurrence for the NTS and for Yucca Mountain. |
| 3.1.4.1.1.2.9-2 | Probability of occurrence of extreme temperatures. |
| 3.1.4.1.1.2.9-3 | One and 24-hour maximum precipitation and probability of occurrence. |
| 3.1.4.1.2-1 | Map of the Yucca Mountain Site showing meteorological monitoring stations. |
| 3.1.4.1.3-1 | Wind roses for each stability class. |
| 3.1.4.1.3-2 | Stability Class Distributions. |