A-0297

PDR
LPDR - WM-10 (2)
WM-11 (2)
WM-16 (2)

Lawrence Livermore National Laboratory

NUCLEAR SYSTEMS SAFETY PROGRAM
L-196

WM Record File WM-RES
A0297
LLL

WM Project 10, 11, 16
Docket No.
PDR ✓
XLPDR ✓ (B, N, S)

February 9, 1987

Distribution:
Blackford
(Return to WM, 623-SS)
Sac

Mr. M. E. Blackford, MS-623ss
Project Officer, WMGT
Geotechnical Branch
Division of Waste Management, NMSS
U.S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: LLNL Plans for Review of SCP's

Reference: NRC FIN A0297

Dear Mr. Blackford:

The purpose of this letter is to set forth our LLNL team plans for review of DOE's Site Characterization Plans (SCP's).

In our effort to prepare ourselves in advance for the subject review and evaluation of SCP's, we are pleased to report our organizational plans as follows:

1. On the basis of "Annotated Outline For Site Characterization Plans", we anticipate that the LLNL team will have a major role in Chapters 1 through 7. We will make our input in Chapter 8 known to other NRC teams.

2. We have assigned those individuals named below with specific chapter(s) and section(s) within any particular SCP's.

   Norm Burkhard, seismologist; all sites
   Dave Carpenter, engineering geologist; salt site leader
   Dae (Danny) Chung, geophysicist; project leader
   Dick Galster, geologist; BWIP geology
   Larry McKague, geologist; NNWSI site leader
   Russ Purcell, geomorphomologist; NNWSI and salt sites
   Burt Slemmons, tectono-geologist; BWIP site leader

   Note that in addition to the above named members of our staff, several graduate students will participate in the review of SCP's.

   Note also that Dae (Danny) Chung is responsible for all sites, assisted by site leaders (Carpenter, McKague and Slemmons).

3. As in the attached marked copy of "Annotated Outline For Site Characterization Plans", we identified names of the LLNL team with

Attachment in pocket #1 (1987)

3632

five (5) review categories as:

(1) Review and Comment
(2) Read for Information
(3) Lead Role
(4) Expertise
(5) Assignment

The categories (1) through (5) are marked (X) on the attached marked copy of the annotated outline for SCP's.

If you have any questions, please let me know.

Sincerely yours,

Dae H. (Danny) Chung
Leader
NRC Nuclear Waste Management Project

DHC/ic
Attachment as stated.

cc: J. S. Trapp, WMGT

A-0297

W/ltr. dtd. 2/9/87

To: M.E. Blackford

Fm: Mac H. Chung

PROJECT BWIP

	(1) Review and Comment	(2) Read for Information	(3) Lead Role	(4) Expertise	(5) Assignment	
ANNOTATED OUTLINE FOR SITE CHARACTERIZATION PLANS						
INTRODUCTION			X			BS/RG
PART A: DESCRIPTION OF SITE, WASTE PACKAGE, AND REPOSITORY DESIGN						
Chapter 1 - GEOLOGY		X		X		BS/RG
1.0 INTRODUCTION						
1.1 GEOMORPHOLOGY		X		X		RP
1.1.1 Physiography						
1.1.2 Geomorphic Units						
1.1.3 Geomorphic Processes						
1.2 STRATIGRAPHY AND LITHOLOGY		X		X		BS
1.2.1 Stratigraphic Framework of the Candidate Area						
1.2.2 Stratigraphic Framework of the Site						
1.3 STRUCTURAL GEOLOGY AND TECTONICS OF CANDIDATE AREA AND SITE		X		X		BS
1.3.1 Tectonic Framework						
1.3.2 Tectonic History						
1.3.2.1 Volcanic History						
1.3.2.2 Structural History						
1.3.2.3 Existing Stress Regime						
1.3.2.4 Vertical and Lateral Crustal Movement						
1.3.2.5 Geothermal Regime						
1.4 SEISMOLOGY OF CANDIDATE AREA AND SITE		X		X		BS
1.4.1 Seismology of Candidate Area						
1.4.1.1 Seismicity of Candidate Area						
1.4.1.2 Relationship of Seismicity to Geologic or Tectonic Characteristics of Candidate Area						
1.4.1.3 Determination of Earthquake-Generating Potential of Geologic Structures and Seismo-Tectonic Zones Within Candidate Area						
1.4.1.4 Earthquake-Induced Phenomena Within Candidate Area That May Affect Site						
1.4.1.5 Seismic Hazard in the Candidate Area						
1.4.2 Seismology of the Site						
1.4.2.1 Vibratory Ground Motion at Site Resulting from Potential Earthquakes in Area						
1.4.2.2 Characteristics of Seismic Wave Transmission at Site						
1.4.2.3 Potential for Induced Seismicity Affecting Site						

*see page ix

(1) (2) (3) (4) (5)

Section

Section (1) (2) (3) (4) (5)

(1) (2) (3) (4) (5)

Section

(1) (2) (3) (4) (5)

Section —

L.M. - Larry McKague
D.C. - Dave Carpenter
R.P. - Russ Purcell
B.S. - Burt Slemmons
R.G. - Richard Galster

1.7 Mineral and hydrocarbon resources

- Petroleum Potential of Anticlines

1.8 Summary

2.6 Existing stress regime

4.1.1 Mineralogy and petrology

8.3.1.2 Geology

8.3.1.6 Resource potential

PROJECT BWIP

TASK 6 and 7

1.1 Geomorphology

1.2 Stratigraphy and Lithology

1.3 Structural geology and tectonics of candidate area and site

- Compressional Tectonics
- Anticline/Thrust Development
- Rooted/Non Rooted Origin of Folds and Thrusts

1.4 Seismology of candidate area and site

- Microseismicity
- Earthquake Swarms

1.5 Long term regional stability with respect to tectonic and geologic processes

1.6 Drilling and mining

- Catalogue of Drill Holes
- Completion of Drill Holes

PROJECT NNWSI

ANNOTATED OUTLINE FOR SITE CHARACTERIZATION PLANS

	(1) Review and Comment	(2) Read for Information	(3) Lead Role	(4) Expertise	(5) Assignment
INTRODUCTION.		X			LM
PART A: DESCRIPTION OF SITE, WASTE PACKAGE, AND REPOSITORY DESIGN. .					
Chapter 1 - GEOLOGY	X		X		LM
1.0 INTRODUCTION.	X		X		LM
1.1 GEOMORPHOLOGY	X		X		RP
1.1.1 Physiography					
1.1.2 Geomorphic Units					
1.1.3 Geomorphic Processes					
1.2 STRATIGRAPHY AND LITHOLOGY.	X		X		LM
1.2.1 Stratigraphic Framework of the Candidate Area.					
1.2.2 Stratigraphic Framework of the Site.					
1.3 STRUCTURAL GEOLOGY AND TECTONICS OF CANDIDATE AREA AND SITE . .	X		X		LM
1.3.1 Tectonic Framework					
1.3.2 Tectonic History					
1.3.2.1 Volcanic History.					
1.3.2.2 Structural History.					
1.3.2.3 Existing Stress Regime.					
1.3.2.4 Vertical and Lateral Crustal Movement					
1.3.2.5 Geothermal Regime					
1.4 SEISMOLOGY OF CANDIDATE AREA AND SITE	X		X		LM
1.4.1 Seismology of Candidate Area					
1.4.1.1 Seismicity of Candidate Area.					
1.4.1.2 Relationship of Seismicity to Geologic or Tectonic Characteristics of Candidate Area. . .					
1.4.1.3 Determination of Earthquake-Generating Potential of Geologic Structures and Seismo-Tectonic Zones Within Candidate Area					
1.4.1.4 Earthquake-Induced Phenomena Within Candidate Area That May Affect Site					
1.4.1.5 Seismic Hazard in the Candidate Area.					
1.4.2 Seismology of the Site					
1.4.2.1 Vibratory Ground Motion at Site Resulting from Potential Earthquakes in Area					
1.4.2.2 Characteristics of Seismic Wave Transmission at Site					
1.4.2.3 Potential for Induced Seismicity Affecting Site					

*see page ix

(1) (2) (3) (4) (5)

Section

Section — (1) (2) (3) (4) (5)

L.M. - Larry McKague
D.C. - Dave Carpenter
R.P. - Russ Purcell
B.S. - Burt Slemmons

PROJECT NNWSI

TASK 6 and 7

1.1 Geomorphology

- Erosion rates
- Soil Formation
- Soil/terrace/fan chronology

1.2 Stratigraphy and Lithology

1.3 Structural geology and tectonics of candidate area and site

- Listric faults
- Strike slip faulting
- Age of faulting
- Basaltic magmatism

1.4 Seismology of candidate area and site

- Microseismisity
- Focal mechanisms

1.5 Long term regional stability with respect to tectonic and geologic processes

- Regional and local tectonic model

1.6 Drilling and mining

- Catalogue of holes
- Completion information
- Catalogue of mines

1.7 Mineral and hydrocarbon resources

- List of prospects and mines
- Potential for economic mineral deposits below ash flow sheets

1.8 Summary

2.6 Existing stress regime

- Summary of current borehole information
- Level line data/interpretation
- Variation of stress with depth

4.1.1 Mineralogy and petrology

- Vertical and horizontal variations in mineralogy/chemistry/petrology

8.3.1.2 Geology

8.3.1.6 Resource potential

PROJECT SALT

	(1) Review and Comment	(2) Read for Information	(3) Lead Role	(4) Expertise	(5) Assignment	
ANNOTATED OUTLINE FOR SITE CHARACTERIZATION PLANS						
INTRODUCTION						
PART A: DESCRIPTION OF SITE, WASTE PACKAGE, AND REPOSITORY DESIGN						
Chapter 1 - GEOLOGY	X		X			DC
1.0 INTRODUCTION	X		X			DC
1.1 GEOMORPHOLOGY	X		X			RP
1.1.1 Physiography						
1.1.2 Geomorphic Units						
1.1.3 Geomorphic Processes						
1.2 STRATIGRAPHY AND LITHOLOGY	X		X			DC
1.2.1 Stratigraphic Framework of the Candidate Area						
1.2.2 Stratigraphic Framework of the Site						
1.3 STRUCTURAL GEOLOGY AND TECTONICS OF CANDIDATE AREA AND SITE	X		X			DC
1.3.1 Tectonic Framework						
1.3.2 Tectonic History						
1.3.2.1 Volcanic History						
1.3.2.2 Structural History						
1.3.2.3 Existing Stress Regime						
1.3.2.4 Vertical and Lateral Crustal Movement						
1.3.2.5 Geothermal Regime						
1.4 SEISMOLOGY OF CANDIDATE AREA AND SITE	X		X			LM
1.4.1 Seismology of Candidate Area						
1.4.1.1 Seismicity of Candidate Area						
1.4.1.2 Relationship of Seismicity to Geologic or Tectonic Characteristics of Candidate Area						
1.4.1.3 Determination of Earthquake-Generating Potential of Geologic Structures and Seismo-Tectonic Zones Within Candidate Area						
1.4.1.4 Earthquake-Induced Phenomena Within Candidate Area That May Affect Site						
1.4.1.5 Seismic Hazard in the Candidate Area						
1.4.2 Seismology of the Site						
1.4.2.1 Vibratory Ground Motion at Site Resulting from Potential Earthquakes in Area						
1.4.2.2 Characteristics of Seismic Wave Transmission at Site						
1.4.2.3 Potential for Induced Seismicity Affecting Site						

*see page ix

Section	(1)	(2)	(3)	(4)	(5)
5.2.2 Future Climatic Variation.					
5.2.3 Site Paleoclimatic Investigation		X		X	RP
5.3 SUMMARY					
5.3.1 Summary of Significant Results					
5.3.2 Relation to Design					
5.3.3 Identification of Information Needs.					
5.3.4 Relation to Regulatory Guide 4.17.					
REFERENCES.					
Chapter 6 - CONCEPTUAL DESIGN OF A REPOSITORY		X		X	DC
6.0 INTRODUCTION.					
6.1 DESIGN BASIS.					
6.1.1 Repository Design Requirements					
6.1.2 Reference Design Data Base					
6.1.3 Analytical Tools for Geotechnical Design					
6.1.4 Structures, Systems, and Components Important to Safety.					
6.1.5 Barriers Important to Waste Isolation.					
6.2 CURRENT REPOSITORY DESIGN DESCRIPTION					
6.2.1 Background					
6.2.2 Overall Facility Design.					
6.2.3 Repository Operations.					
6.2.4 Design of Surface Facilities					
6.2.4.1 Foundation Considerations					
6.2.4.2 Flood Protection.					
6.2.5 Shaft and Ramp Design.					
6.2.6 Subsurface Design.					
6.2.6.1 Excavation, Development, and Ground Support . .					
6.2.6.2 Ground-water Control.					
6.2.6.3 Ventilation					
6.2.7 Backfill of Underground Opening.					
6.2.8 Shaft and Borehole Seals					
6.2.8.1 Shaft Seal Characteristics.					
6.2.8.2 Shaft Seal Emplacement.					
6.2.8.3 Borehole Seal Characteristics					
6.2.8.4 Borehole Seal Emplacement					
6.3 ASSESSMENT OF DESIGN INFORMATION NEEDS.					
6.3.1 Introduction					
6.3.2 Design of Underground Openings					
6.3.3 Backfill					
6.3.4 Strength of Rock Mass.					

Section		(1)	(2)	(3)	(4)	(5)
8.2.1.1	Mission Plan Issues					
8.2.1.2	Site-Specific Issues					
8.2.2	Approach to Issue Resolution					
8.3	PLANNED TESTS, ANALYSES, AND STUDIES					
8.3.1	Site Program					
8.3.1.1	Overview					
8.3.1.2	Geology	X		X		DC
8.3.1.3	Hydrology					
8.3.1.4	Geochemistry					
8.3.1.5	Climatology					
8.3.1.6	Resource Potential	X		X		LM
8.3.2	Repository Program					
8.3.2.1	Overview					
8.3.2.2	Verification or Measurement of Environment					
8.3.2.3	Coupled Interaction Tests					
8.3.2.4	Design Optimization Activities and Tests					
8.3.2.5	Repository Modeling					
8.3.3	Seal System Program					
8.3.3.1	Overview					
8.3.3.2	Seal System Environment					
8.3.3.3	Seal System Components and Interaction Tests					
8.3.3.4	Seal System Design Optimization					
8.3.3.5	Seal System Modeling					
8.3.4	Waste Package Program					
8.3.4.1	Overview					
8.3.4.2	Waste Package Environment					
8.3.4.3	Waste Package Components and Interaction Testing					
8.3.4.4	Waste Package Design Development					
8.3.4.5	Waste Package Modeling					
8.3.5	Performance Assessment Program Plan					
8.3.5.1	Strategy for Preclosure Performance Assessment					
8.3.5.2	Strategy for Postclosure Performance Assessment					
8.3.5.2.1	Plans for Assigning and Assessing Engineered Barrier Subsystem and Component Performance Goals					
8.3.5.2.2	Plans for Assigning and Assessing Seal Systems Performance Goals					
8.3.5.2.3	Plans for Assessing the Contribution of Site Characteristics to Site Subsystem Performance					
8.3.5.2.4	Plans for Assessing System Performance					
8.3.5.3	Plans for Demonstrating Compliance with EPA Standards, NRC Preclosure Postclosure Performance Objectives, and DOE Siting Guidelines					
8.3.5.4	Substantially Completed Analytical Techniques					
8.3.5.5	Analytical Techniques Requiring Significant Development					

Section. (1) (2) (3) (4) (5)

L.M. - Larry McKague
D.C. - Dave Carpenter
R.P. - Russ Purcell
B.S. - Burt Slemmons

PROJECT Salt

TASK 6 and 7

1.1 Geomorphology

- Relationship of playas to salt dissolution and structure.

1.2 Stratigraphy and Lithology

- Dissolution potential at site.

1.3 Structural geology and tectonics of candidate area and site

- Faults penetrating salt from underneath
- Quaternary movement along faults
- Potential for unmapped faults within 12 km of site

1.4 Seismology of candidate area and site

- Microseismicity/structure relationship
- Attenuation relations
- Current seismicity

1.5 Long term regional stability with respect to tectonic and geologic processes

1.6 Drilling and mining

1.7 Mineral and hydrocarbon resources

1.8 Summary

2.6 Existing stress regime

4.1.1 Mineralogy and petrology

8.3.1.2 Geology

8.3.1.6 Resource potential